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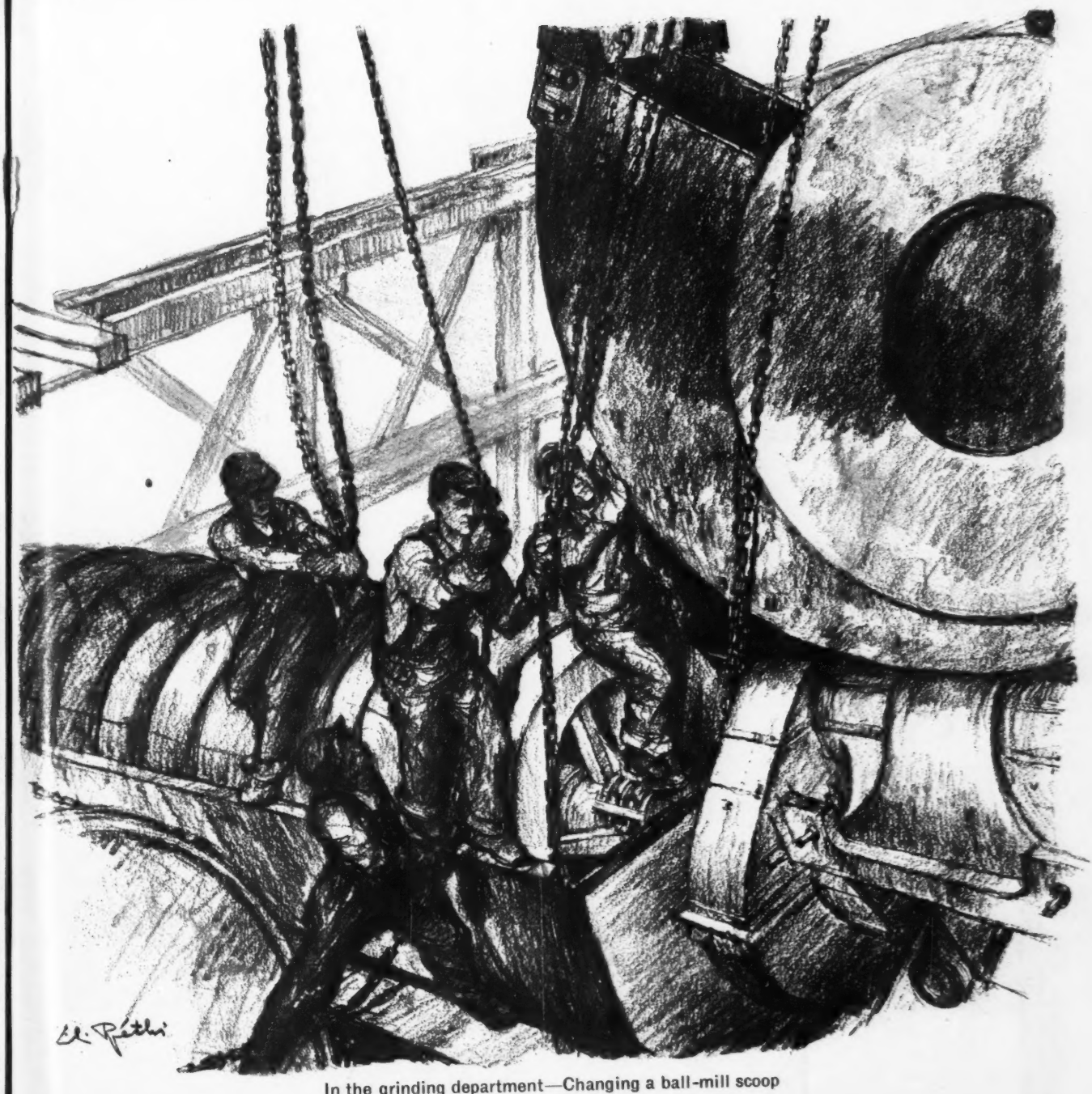

In the grinding department—Changing a ball-mill scoop

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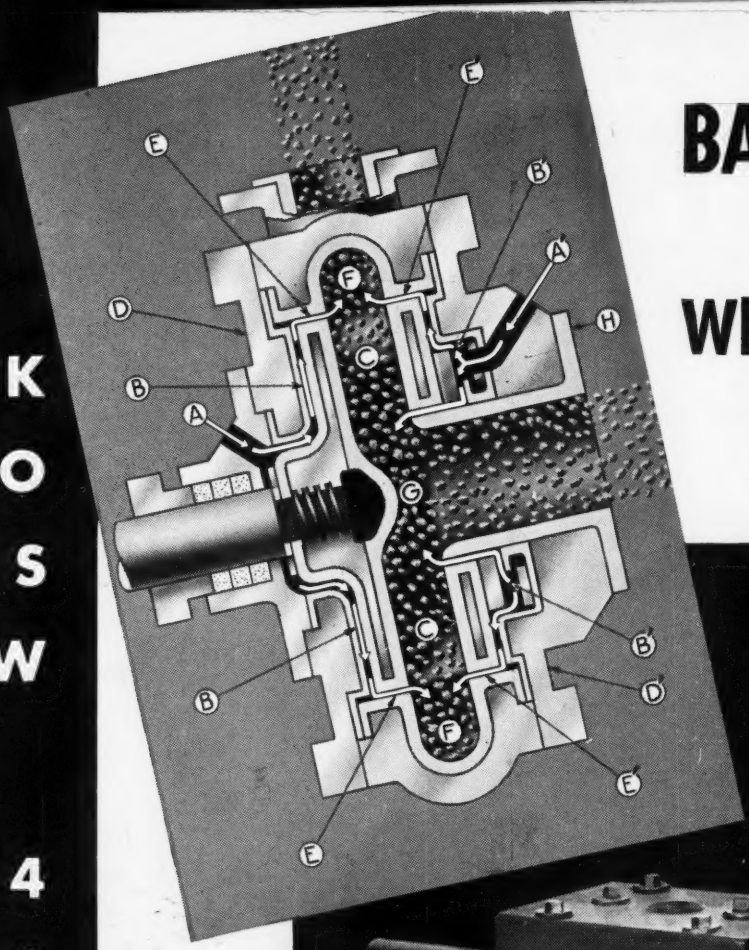

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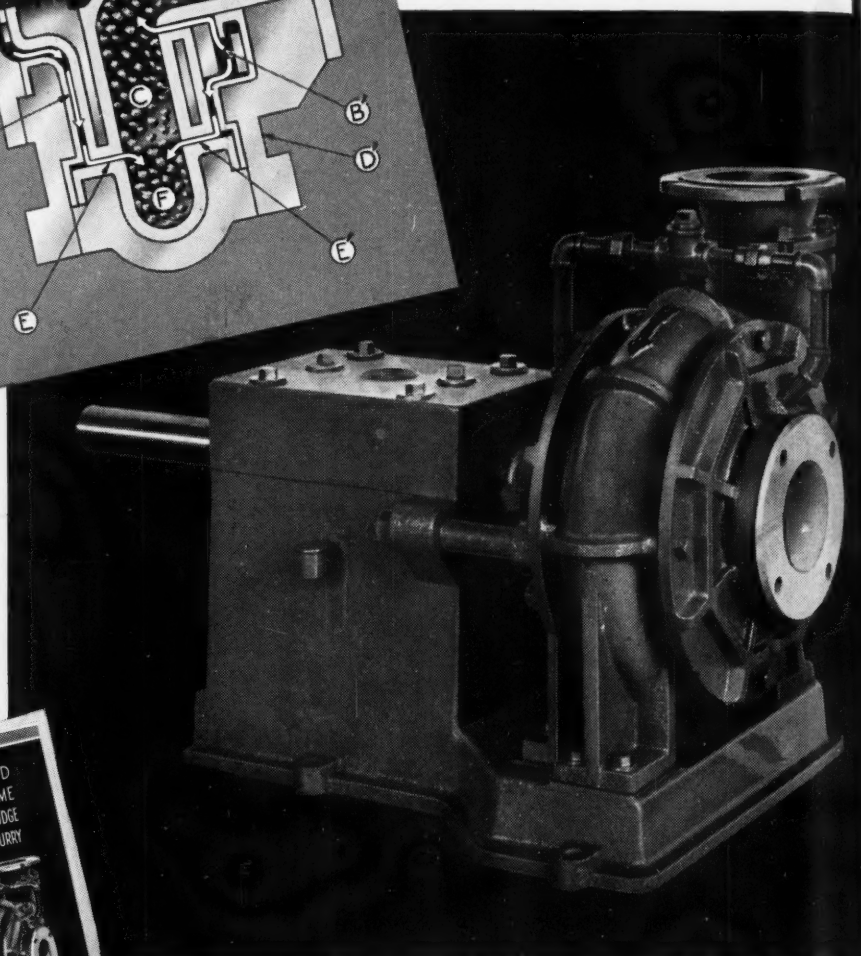

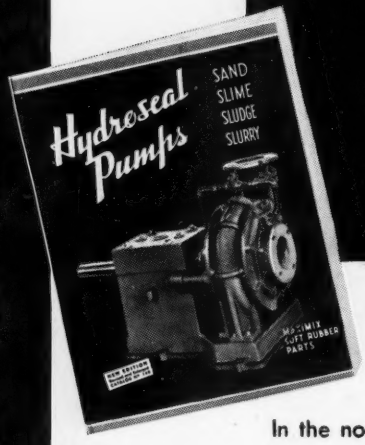

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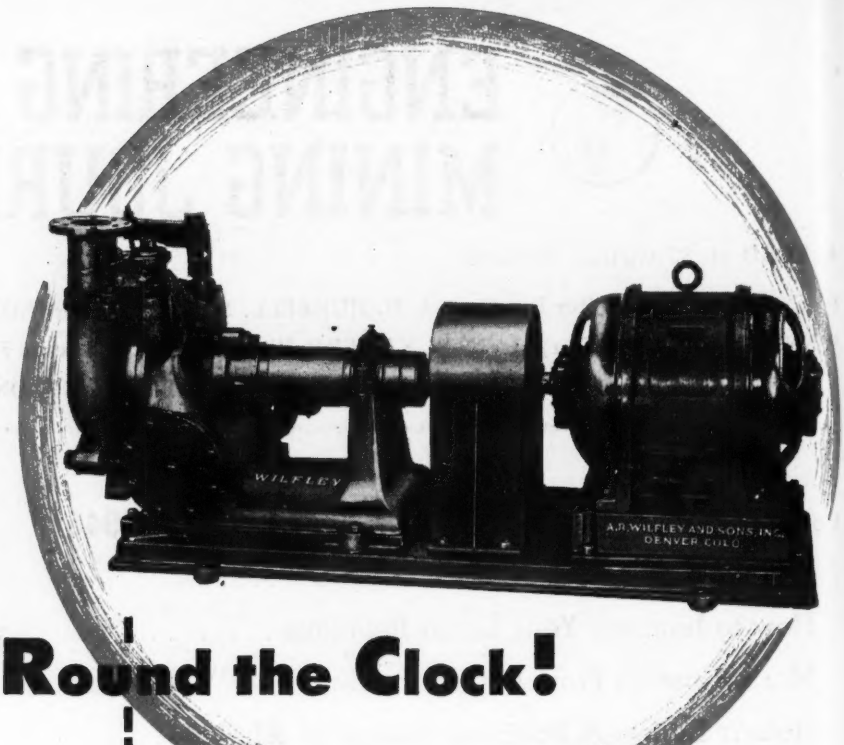

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AMERICA WANTS COMPETITION

Only American Initiative Can Preserve It in World Trade

AMERICANS generally agree upon what constitutes a desirable pattern of international economic relationships. We want an expanding world trade, with minimum recourse to government-imposed trade barriers and discriminatory trading arrangements, and offering ample scope for competitive private enterprise. Because they are necessary to such trade, we want also stability of exchange rates, and national currencies that are mutually convertible at least for the settlement of current accounts. We want, too, arrangements to facilitate long-term capital loans with security to the lender and advantage to the borrower.

Few other nations subscribe to these aims with enthusiastic conviction. Some reject them flatly as impractical under the conditions likely to prevail during the postwar period, or achievable only at prohibitive cost to their domestic economies.

Unless, therefore, we can formulate a practical and comprehensive program to carry out our aims, and convince other nations that we will take a sustained and responsible part in making it effective, the international trade of the world surely will be conducted under a system of exchange controls, bilateral agreements, cartel bargains, import quotas, and direct government purchasing arrangements that are the very antithesis of the competitive system that we favor.

To agree upon a concrete American **program,** and to convince other nations that it is to their advantage as well as ours to accept it, is a major task of economic statesmanship. It entails reversing a trend which has persisted since World War I, and which has been intensified during the depression years of the nineteen-thirties and by the exigencies of World War II.

Clearly, that is not a task to be assumed lightly. We can hope to be successful only if (1) we have a deep conviction that what we seek is fundamentally important to the American interest, and (2) if we will take pains to understand why other nations fear that such a program may jeopardize their interests, and then make whatever accommodations may be necessary to resolve their doubts.

An expansive foreign trade policy has been advocated so vigorously and repeatedly in America recently that The Economist (of London) comments wryly upon what it terms the ironic circumstance that "the acceptance of the principles of free trade by the more literate (American) public should come at a time when the doctrines in their simplest nineteenth-century form have been pretty generally emasculated in fact and repudiated in principle by the rest of the world".

☆ ☆ ☆

Why are we opposed to managed world trade, and for competitive world trade?

First, we are against rigged and managed international markets because we know that successful participation necessitates a comparable degree of control over the domestic economy as well. There is little debate of this fact, and those nations which accept a managed external trade as a necessary protective measure are generally willing to pay the price in internal regimentation. We are not. For us to do that would be as alien to our genius as it is repugnant to our conviction.

Second, we believe that the United States will be able to compete successfully in world markets, even though we have, and intend to maintain, wage scales far higher than those of the nations whose competition we must meet.

There is impressive evidence to substantiate the soundness of this conviction:

1. Wage scales, of themselves, do not determine the competitive position. They are meaningful only when translated into labor costs, by dividing wage rates by units produced. **A recent War Production Board study shows that in manufacturing industries generally, during the period immediately before the present war, production per man hour in the United States exceeded that in the United Kingdom, Germany and Soviet Russia by a ratio of more than 2½ to 1, and that of Japan by more than 4 to 1.** When comparison is made with available wage data, it appears that our labor costs are generally on a competitive plane.

2. Perhaps the best evidence of our ability to compete in export markets is the record of our demonstrated capacity to do so in the past. **During the entire period between World Wars I and II, the United States consistently commanded a greater share of the world's export trade than any other nation,** although the United Kingdom took a larger percentage of world imports.

3. We have been particularly successful in world trade competition in the export of machinery, vehicles, a variety of manufactured specialties, and certain agricultural products. Except in the last-named field, there is every evidence that we enjoy genuine competitive advantage over other nations, and this advantage will have been increased rather than diminished by developments during the Second World War. It is noteworthy that the goods in which we have been able to compete most successfully have generally been the products of our high wage industries rather than those in which low wages have prevailed.

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It is clear that, on a price basis, we shall be able to compete successfully in postwar markets in numerous lines. It is equally clear that such an opportunity is by no means of negligible importance to our own economy as a whole. During the years in which the censuses were taken between 1909 and 1939, our exports amounted

to from 7 to 16 per cent of our entire production of movable goods. **In the year 1938 our exports in each of the following lines accounted for more than 10 per cent of total domestic production of the particular product.**

(The figures in parenthesis are the percentages of total production exported.)

CRUDE MATERIALS: Phosphate rock (51.5), cotton (30.5), tobacco (29.4).

FOODSTUFFS AND BEVERAGES: Linseed (49.4), dried fruits (36.2), canned sardines (29.4), rice (21.0), fresh pears (15.9), canned salmon (13.8), canned asparagus (13.2), canned fruits (13.0), wheat (12.2), lard (11.7).

SEMI-MANUFACTURES AND FINISHED MANUFACTURES: Refined copper (53.1), paraffin wax (46.3), gum turpentine (42.6), carbon black (40.8), gum rosin (38.0), borax (35.9), crude sulphur (35.6), aircraft and parts (26.8), office appliances (22.3), carbons and electrodes (21.8), printing and bookbinding machinery (18.2), agricultural implements and machinery (17.0), biologic pharmaceuticals (15.3), industrial machinery (14.4), dental instruments and supplies (14.3), automobiles (14.1), benzol (13.3), goat and kid upper leather (12.8), refined lead (12.0), radio apparatus (11.8), caustic soda (11.4), refined mineral oils (10.6).

It is of major concern to all engaged in these lines of activity and in many others that foreign markets be not closed to us. It is particularly to our interest to have export outlets for our war-expanded capital goods and equipment industries. Since we undertook an important percentage of such expansion in order to furnish munitions to our Allies, it is reasonable to ask their cooperation in cushioning what inevitably must be a drastic readjustment here. The case is strengthened by the fact that the postwar world will desperately need the equipment items that we, alone, can supply.

But our demonstrated ability to compete on a price basis will not, of itself, assure us of foreign market outlets. Transportation costs, quality of product, marketing skill, technical and repair service—all are basically important. Still more important are non-discriminatory open markets and the command of dollar exchange by prospective purchasers. Our export potentials will surely be cramped in a world organized on the basis of bilateral deals and exchange controls. The availability of dollar exchange must depend upon the level of American imports and the volume of American capital loans.

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How are we to explain the skepticism of other nations toward an order which to us seems so clearly to represent not only our interest but the long-range interest of the world as well?

Soviet Russia, of course, is committed to conducting its external trade through its central government. But what of the United Kingdom? Why are there so many British voices that counsel the abandonment of what has been Britain's traditional position for more than a century? If we can understand that, we shall understand the dissent from our position of most nations whose economic positions have weakened and whose fiscal problems have multiplied during the two World Wars and the ill-starred period between them.

Essentially, their case is this:

Partly, they were forced into managed external trade policies by the Axis self-sufficiency programs, adopted in preparation for aggressive war. That can be corrected only by crushing the Axis, and by establishing a world security system that will make self-sufficiency a less compelling need.

But primarily, the reluctance of peaceably inclined nations to forego restrictive controls over postwar foreign trade stems from a deep-seated fear that is even more difficult to resolve. They fear, on the basis of past experience, that their efforts to meet payment balances arising from normal foreign trade would force a deflation of their internal economies, affecting prices, credit, wages, and finally employment. Faced with the choice, as they see it, between making adjustments in foreign trade or in their domestic economies, they lean toward the former as, at worst, the lesser of two evils.

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Since the kind of world trade system we seek is dependent upon international arrangements to assure reasonable stability of exchange rates between national currencies, we are challenged to find a formula that both will provide this and at the same time allay what other nations believe are legitimate fears with respect to their domestic economies.

But at least two major steps toward resolving such doubts can be taken upon our own initiative without recourse to the intricate process of international negotiation.

One is the rational overhauling of our tariff system, to provide other nations with increased opportunity to export to us. We can, and should, do this in a way that avoids undue cost to any segment of our economy.

The other, and probably the greatest contribution we can make toward winning a reluctant world to our point of view, will be to offer ample and convincing evidence that we are ready and able to provide a high level of employment in the United States. If we can do that, the rest of the world will wish to expose itself to our influence rather than to insulate against it, since prosperity here is the greatest single contributing factor to world-wide prosperity.

Balance of payment problems are minimized in a world of thriving trade. Britain would have little reason to resort to exchange controls if the total of postwar world imports and exports reaches an 80 billion dollar level. She may well be in a desperate plight if it should revert to the 1935 level of 40 billions.

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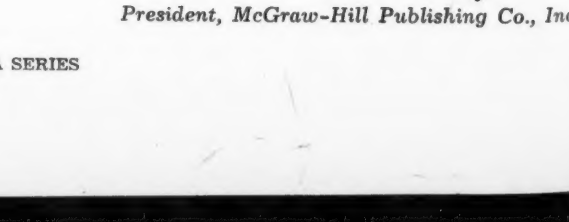
The United States wants a world in which private enterprise and competition play a major role. To obtain such a world will require a wiser, more understanding and firmer world leadership than this nation, or perhaps any nation, ever has exerted heretofore.



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ENGINEERING AND MINING JOURNAL

Peaceful Labor Relations Are Essential

TO ELABORATE on the importance of labor relations to the mining industry is superfluous. In view of this importance, *E.&M.J.* intends to devote more space to labor problems as a means of serving the industry in this vital field. The article by Mr. Gorsuch in this issue is an example.

Broadly speaking, we believe that labor trouble is a luxury which private enterprise and freedom-loving individuals cannot afford in the future. The price of failure to settle differences between management and labor "within the shop" will be a loss of liberty for all. We cannot afford to perpetuate the present unsatisfactory system of having government tribunals resolve local problems.

The principal obstacle to labor peace, in our opinion, is not a serious difference in objectives of labor and management, but simply misunderstanding of each other's objectives. Each has a fundamental willingness to live and let live, but this tolerance is commonly colored by misinformation or erroneous assumptions.

In the mining industry one cannot know the men who manage without realizing that there are few "barons" among them. One cannot mingle with workmen and believe that more than an insignificant portion would knowingly destroy the industry that employs them. Yet, when these men get together to discuss what are fundamentally mutual problems, usually suspicion fills the air and each holds his cards close to his chest. They fail to unbend and be simply human to each other, and too often lawyers, out to gain all they can for their clients and yield as little as possible, dominate the negotiations. We submit that the "courtroom approach" is poor business in labor relations, which should be handled as family affairs.

We believe it is not only evident that collective bargaining is here to stay—witness the numerous polls taken on this subject—but that the wise employer will do his best to build it up as a free institution rather than merely to accept the compulsions of the Wagner Act reluctantly. If we can make collective bargaining work, it may prove to be one of the most solid barriers to the present drift toward totalitarianism.

This sounds idealistic. Considering long-range alternatives, we insist it is practical. Labor problems will be solved locally in a "family" spirit, or they will continue to serve as openings for ambitious bureaucrats to apply controls to everything and everybody. To say that the growth of totalitarian compulsions threatens management more than labor is shallow reasoning. When capital has been thoroughly shackled, it will not be long until people will be told where they can or cannot work. From this point it is a mere step to solving all domestic problems with firing squads.

Out of pure self-interest, management should try to help unions develop other bases for existence beyond that of maintaining incessant pressure for higher wages. There is serious danger that unrelenting pressure for wage increases may destroy many chances to create jobs in the future, which would certainly not be to the best interests of mine labor. Management should be prepared to divulge facts about the business, so that workmen can understand management problems.

Labor, on the other hand, should strive to understand what management is up against and to avoid practices which hamper efficiency. Workmen should insist that their unions be run democratically, with the fullest possible local self-government. It is up to labor to realize that it has an obligation to develop constructive leadership and responsibility for its commitments.

Both labor and management can do a better job in humanizing their contacts, in developing an atmosphere of mutual trust, and in realizing that they have more in common than in opposition.

In short, with the tools that technology has provided, we can provide good living for all, if we can learn to live in our house together without pulling the roof in on each other's heads. If we fail to learn how, we shall still have to live together, but with a voracious, relentless, storm trooper billeted in our midst.

California Gold Dredging Under Attack

IN CALIFORNIA there is a furor over the leveling and resoiling of dredged areas. Those who demand that dredged lands should be returned to a cultivable state are loudly decrying the destruction of scenic beauty and the loss of valuable agricultural land.

Realizing that a dredged area presents a desolate sight which arouses emotional reactions in average people, it is important to realize that if California wants resoiling it will have to get along without most of the gold dredging industry and its important contribution to the State's wealth and employment in normal times. Most of the industry simply could not bear the cost of segregating the topsoil, burying the boulders, leveling the tailings, and resoiling.

The scenic argument has little weight because most of the dredging areas are not in scenic places. As for the destruction of cultivable land, most dredging areas do not have important agricultural value and the total dredge area, past and potential, is only 0.7 percent of California's cropland. Only about one tenth of the dredge land is or was cultivable; thus the percentages of cropland is insignificant.

In view of these facts it seems as though the uproar is entirely out of proportion to the importance of the problem. It is to be hoped that the California Legislature will make its decision after a sober scrutiny of the facts available and not let an emotional solution wreck a valuable industry.

Patents of Government Employees

A WELCOME STEP in clarifying the rights of government employees to patented inventions and discoveries made in the course of their employment is contained in the Patent Manual recently published for employees of the U. S. Department of Agriculture. The general subject has long been a matter of controversy, and some past examples of abuse of the patent privilege have generated considerable heat in industrial circles without throwing much light on a fair solution of the problem. Whether or not a federal policy for all government employees is ever determined, the steps being taken by separate departments may result ultimately in reasonably uniform practice.

Some time ago Secretary Ickes announced that patented inventions and discoveries made by employees of the Department of the Interior in the course of official duties belong to the government and not to the individual. But it has remained for the Department of Agriculture to formulate and publish the most explicit statement of policy that has come to our notice. That the Department is motivated by the same objectives held by industrial research organizations is evident in the policy statement:

"The United States Department of Agriculture includes one of the largest research organizations in the world, and obtaining patents is considered by the Department to be an important supplement to its research activities. It is impractical to deal on a modern basis with such large-scale research without an adequate supporting patent program." A basic element of the Department's policy is that "An invention made as a result of research in the Department belongs to the public, which paid for it through taxation."

All inventions made by employees of the Department within the scope of its activities must be submitted to the Secretary. If the invention is within the assigned duties of the employee he must dedicate a resulting patent to the public; or, if administrative control is desired, the patent will be assigned to the Secretary of Agriculture. If the invention is not within the scope of the inventor's employment, and if it is of interest to the Government, the latter retains a shop right and all other commercial rights remain in the inventor.

Precious Metals Should Enjoy Depletion Allowances

A STUDY of the WPB-OPA premium-quota plan, as described to a Senate committee (Print No. 6 of the mining and minerals subcommittee of the Senate Committee on Small Business, pp. 107–108) reveals that the Western mines are treated on essentially a cost-plus basis with very little increased benefits as gold and silver values mount. There can be no complaint that premiums are not paid for gold and silver, but under the plan as applied nearly all of what the smelter pays the operator for these metals is taken away by reducing the premium on lead, zinc, and copper. In other words, any silver or gold in the ore is not an asset to the operator; moreover, virtually no depletion credit is given for their extraction.

In the computations, 50 percent is added to the allowed "margin" for mine ownership. This is in effect a 50 percent of net income depletion allowance, the same being more or less in conformity with depletion deductions permitted under the tax laws. Inasmuch as the "margin" only slightly reflects gold and silver values, the available depletion allowance is similarly affected. We believe that the plan

should be modified to give gold and silver the same depletion treatment as other values. The present treatment is inconsistent with the premises on which depletion deductions are based.

Parity Prices No Real Solution

AT THE MEETING of the Colorado Mining Association in late January, Carl H. Wilken, economic analyst for the National Association of State Agricultural Commissioners, presented an interesting proposal for parity pricing of all raw materials and creation of a farm-mineral alliance for mutual benefit.

Mr. Wilken based his views on the alleged fact that the "total labor force divided by the portion engaged in raw material production, times the raw material income is, has been, and always will be the national income of the United States." This observation was qualified by the assertion that the raw-material figures antedate the national figures by six months and can therefore be used as a reliable basis for prophesying the national picture six months later.

In consequence of this statistical relationship, Mr. Wilken proposes to stabilize national income by establishing parity prices on raw materials.

This seems like a beautifully simple solution to a problem that has "stumped" lots of smart people for a long time. We wish we could believe it would work. However, even though a certain statistical goal might conceivably be attained by such a procedure, it is certainly not possible that "real" economics can be thus stabilized.

Considering the number of people in the industry today who yearn for stabilization of their wages, costs, or incomes, the idea of parity prices is a tempting one. To people who lean in this direction we can only say that it is time to decide if we really want complete economic stabilization—and its inevitable companion, a totalitarian state—or the free-enterprise system we give so much lip service. If we want the latter and its benefits, certain risks and cyclic economic fluctuations cannot be avoided.

MILLING AROUND

We commend to the attention of all readers interested in mine taxation the competent and readable report adopted by the Yavapai County Council of the Arizona Small Mine Operators Association. The report, by Fred Gibbs, H. F. Mills, and Fred Schemmer, clearly states why new mining enterprises should have a three-year exemption from income taxes in order to attract venture capital into mining. The report cites Canadian experience to prove that such a measure would not only afford mining a needed stimulus, but would increase employment and total taxes.

We wonder if most of our readers will be as surprised as we were to compare the relative dollar-value importance of the principal metal industries (prewar) and to realize that in 1940 gold ($210,108,700) outweighed copper ($205,453,000) and that both exceeded iron ore ($189,086,799). Lead and zinc combined were next ($117,645,000), then aluminum ($75,292,000), silver ($49,483,189), and molybdenum ($17,189,000).

Two recent developments will give thoughtful people something to ponder. One is the drift of Administration policy toward postwar allocation of jobs. The other is the cancellation of government contracts of E. A. Laboratories, Inc.—a death sentence in our controlled war economy—as a means of enforcing WLB decisions.

In recent conferences with leading manufacturers, we have observed that those interests most likely to benefit from larger postwar exports are not contemplating the relaxation of tariff protection on their own products as a means of promoting foreign trade. Thus, we believe that the raw-material industries should develop a defensive alliance to prevent their being sacrificed to manufacturing interests, whose viewpoints dominate Washington economic thinking.

There is widespread dissatisfaction with the present policy of preventing any steps toward reconversion, which is just as hysterically extreme as earlier unwarranted optimism. We predict a build-up of pressures that will force policy toward more rational middle ground. If industry reaches V-E Day still producing at full capacity for war and unprepared for reconversion, there will be tremendous waste and unnecessary hardship. If our official brains are competent and properly informed, they should be able to anticipate by some margin the collapse of Germany and thus ease up on production devoted to that end.

The tone of the President's budget message suggests that the Administration is contemplating differential treatment of holders of government bonds after the war, giving preference to small and individual bondholders.

How to Improve Your

"One thing that has stuck with me through the years is the dynamite tied up in poor labor relations."

WHAT CAUSES most mining labor troubles? Well, if I were a betting man, which I am not since November seventh last, I would wager a tidy sum that you, my readers, would answer that question instantly, "Those blankety-blank government agencies." So be it! I am not going to waste pen or paper trying to defend the accusation. It would serve no purpose except to convince each of us that, as usual, he was right.

What, then, will I do with the space allotted me for this article? Just what I would do if you and I were sitting down after a good dinner, smoking a couple of your cigars, in a quiet corner of some club, and you had asked me the same question: "Gorsuch, what causes most mining labor troubles?" I'd tell you my experiences. So here we go, and I will not apologize for the number of times the word "I" appears hereafter.

Now, let's get this straightened out in the beginning; I am not an expert. I don't claim to be. I never took a single hour of engineering in my life. I never read a book on personnel problems, except "How to Be Happy Though Married," and happily married I am, in spite of the book. I didn't know how to spell "non-ferrous" three years ago, and to this day I am uncertain whether or not it should be hyphenated. I just happened to say "yes" when I probably should have said "no" in October, 1942, when a couple of chaps telephoned me from Washington, telling me that they had a war job for me to do, which would last only three to six months, at the outside.

I was on the spot and I knew it, and, so far as I can see, I am still there, with labor on one side of the table and industry on the other, and

Labor Relations

JOHN E. GORSUCH

Vice Chairman, Non-Ferrous Metals Commission, Denver, Colo.

John E. Gorsuch, as Vice Chairman and one of the two public members of the Non-Ferrous Metals Commission, has for the past two years helped deal with the labor troubles of about 75 percent of the non-ferrous metal mining industry. He has served on the Commission ever since it was set up by the War Labor Board in December 1942 to fix wage rates and working conditions in non-ferrous metal-mining companies in the eleven Western states.

We asked Mr. Gorsuch in preparing this article to list only the things he believes management could do to improve labor relations. We did this because we believe that such improvement must be initiated by management, and because management is principally represented in our readership. Both Mr. Gorsuch and ourselves are well aware that there is also plenty labor could, and must, do toward improving industrial relations.

Mr. Gorsuch has had a unique opportunity to obtain a broad perspective on mining's labor relations; his integrity is widely recognized. We believe, therefore, that E.&M.J.'s readers will find his views worthy of their close attention.

1. Entrust labor relations direction only to men best qualified.
2. Avoid futile rehashing of bygone labor troubles.
3. Know, and take advantage of, the union's set-up.
4. Don't belittle the union before its members.
5. Don't underestimate a union's strength.
6. Substitute cooperation for paternalism.
7. Recognize and accept established labor practices.
8. Keep collective bargaining out of government's hands.
9. Minimize the dollars-and-cents approach to labor.
10. Unify over-all company labor policies.
11. Clarify job classification procedure.
12. Avoid loose talk about unions.

my fellow public member a full-time government expert, whose capabilities are manifold. Don't misunderstand me; my fellow commissioners, past and present, are now and always have been fine, conscientious, and industrious men, doing their best at a tough job.

Labor problems have always intrigued me. When I was working my way through college as a street-car conductor, the union to which I belonged struck, and federal troops and strike breakers were my experience. I have always felt that this strike was ill advised, unnecessary, and the result of poor union leadership.

My first job out of school found me on the other side. I was a white collar man for a Western coal company, and our non-union camp was picketed by Mr. Lewis' followers. We had a machine gun; they had sawed-off shot guns; at least, that's the way I heard it. I never saw them. We would not let them in; they would not let us out.

But the one thing that has stuck with me through the years is the

dynamite that is tied up in poor labor relations.

Choose the Right Man

Now to my thesis: I have always been impressed as to how right my law school professor was when he used to tell us, "The courts are primarily concerned with the law of property, not the law of persons." So, too, do many companies take pains to hire engineers and research men at excellent salaries to look after and develop their physical properties; but the handling of the men themselves is too often just a matter of who is available to hack out a disagreeable job. Frankly, some of the men who have appeared before the Non-Ferrous Metals Commission as management representatives, have, to term it mildly, been misfits of the worst kind.

In other words, top management may be forward-looking in its labor relations, and be perfectly willing to grant better working conditions, but if the person empowered to deal directly with the union grants these in a grudging fashion, or with the attitude that it was done "over his dead body," then better that concessions had never been granted at all.

I remember one company whose personnel director spent most of his allotted time before us telling how the men were being misled by leaders who were not in truth their spokesmen, and how outside union leaders had ruined the camp, and so on. In this case it was a matter of record that the union had been certified years before by NLRB in a decision that had thereafter run the gamut of all possible court appeals. It was, likewise, common knowledge that the company had paid out sizable sums for wrongful discharges, and the number of work stoppages there had been tremendous. Still the company clung to this same personnel director, whose background was one of contention rather than of cooperation; defeat rather than of accomplishment.

Believe me, if glances were poisoned darts, the workers of this company would have caused the demise of this chap during the half hour in which he carried on his tirade before our Commission. You can well imagine what went on in the union meeting when the local's officers returned home from Denver, where we were holding our sessions; and what transpired thereafter in the company's operations. You know the company suffered!

On the other hand, a chap whom I have heard many times present his company's cases, was, to me, from the very beginning, a man who, obviously, knew how to handle labor problems. He was courteous at all times; he respected the union representatives as intelligent adversaries; *he knew them;* he had exhausted all possibility of amicable settlement, but he stood ready and willing to fight, and fight hard, for what he thought were his company's rights in the issues to be settled. Never during the two years that I have known him have I heard the labor men mention his name except with respect. No wonder his company, and it is a giant organization, has entrusted him more and more with important matters involving industrial relations. A smart man working for a smart company.

Suffice it to say that increasingly are we finding that the company's side of the case is being presented by the most competent men available, and not by random choices, because mining management is recognizing the importance of good industrial relations. Therefore, as Point One: the best man you have is none too good to direct your labor problems.

Let the Past Stay Buried

Next, I would humbly suggest, "Quit fighting the battle of Jericho," for it has been over a long, long time. What do I mean? Simply, let bygones be bygones! Sure, it's a bitter pill to swallow a defeat, but once I got my Dad's medicine down (he was a good old-fashioned family doctor), I never liked to let it come up again, and have to stand its awful taste twice.

Really, you would be surprised to know how many times both sides will spend hours before the Commission rehashing the troubled history of their industrial relations, rather than devoting their time to the merits of the dispute. Nothing is accomplished, except a renewal of a feud. As a practical matter, one of the union lawyers, who appears frequently before us, is expert in so goading the company's representatives by a few caustic references to the past that they often fail ever to present their points properly, while he has ample time to hammer home his ideas.

I believe I should mention here, that the War Labor Board, and its subordinate bodies, are, of necessity, compelled to recognize the certifications of the National Labor Relations Board, and this is true, even though the action of the latter Board is on appeal to the courts. In this connection, and in this particular industry, see the Utah Copper cases: 13 WLR 284; 14 WLR 80.

Third, know your union's set-up. Again, again, and again, companies will plead, "We can get along with our local boys, but when that International man comes in, then we quit." Frankly, I take that with a wee bit of the proverbial salt. The fellow I heard yell that the loudest was paying his men the lowest scale in the State, and was far below the minimum of the bracket until the union organizer arrived on the scene.

After all, it seems to me it is a good bit like the local mine superintendent, the general manager, and the New York office. The mine superintendent has certain things he can do and, beyond that, he must refer the issue to the general manager, who, in turn, must refer some decisions to the president and the board of directors, way back there fifty floors above Manhattan. Only in that way can you have unified, responsible management.

So, too, with unions. Local leaders are often inexperienced, and need assistance. Hence, the International field representative. He is, in turn, sometimes a local union leader, who has been elected, or appointed to the job, a short time before, and he also needs the guidance of the International office, or trouble will ensue. Of course, I grant it puts into the hands of the International plenty of power, and when abused it can quickly and easily become a mighty racket; but to me the answer is that inborn in all Americans is the sense of fair play, and, once it is outraged by capital, or labor, or by any other group, sooner or later that group is going to be penalized and brought to time.

Know Your Union

Back to my thesis, to wit: *know your union.* You ask, "Does it pay?" The answer is: "Yes, a thousand times over." Here are a few examples: I know of at least half a dozen instances in the last two years where, for some reason or other, local unions had threatened to stop work, or did stop work, and the company, by communicating with the International representative, and working through him, had the men back to work immediately, and then proceeded with the representative to settle the problems. In two instances, entire mining districts were

involved, and whether you like professional unionists or not, in these cases they produced the goods for management, and that's what counts.

Again, I know of two examples that occurred in the last six months, where the field representatives were none too cooperative, and in both instances the company's top officials had the matter called to the attention of the president of the International, with the result that in both instances the representatives were replaced. In one of these cases, the company and the union had been unable to agree on a single clause, but with the new field man on the job, the entire contract was worked out, and approval by the Commission on a Form 10 was sought and granted. In the second case, the company informant told me that the company's production doubled as soon as both men and management were again able to sit down and work out their problems together in a sensible manner.

Fourth: Don't belittle the union, or its leaders, in front of its members. It just doesn't pay. I can make fun of my church, my country, my family, or even my dog, but *you* had better think twice before you try it. That may sound like "old stuff," but I remember well what bitterness resulted when one company man, in arguing against the check-off, caustically pointed out to a group of men that the only reason the leaders were urging the check-off was that they were losing members because the union was not doing anything for the workers. From that point on, the check-off, which probably had not been a major demand, became a burning issue, and, incidentally, when the battle was over, the company found it had a check-off, by Commission edict, saddled onto its already probably overburdened bookkeeping staff.

A fifth point: Do not underrate your opponent! What I shall say about this particular union is undoubtedly true of others, but, as the International Union of Mine, Mill and Smelter Workers (CIO) has appeared more often before us than any other, I have been in a position to observe it perhaps a little more closely than some of the others. Hence, I use it as an illustration.

Your attorneys may "come high" and from large firms with national reputations, but remember that the union's lawyer will be a chap who lives, breathes, and eats one subject only, and that is labor law. The decisions of the WLB and the NLRB are his Bible, with which he is most familiar. Your man probably has to prime himself for this one case, and his appearance before the Board and the Commission may be his first experience. The union's attorney is likely to be not only a specialist, but a good one with an excellent trial background.

Remember, also, that the attorneys and economists of the union are being daily presented by mining companies with counter briefs, which contain detailed and expensively prepared exhibits, relating to all phases of the mining industry. Each company also files elaborate legal briefs, which the union's well-equipped staff can index, compile, and file to be used in future arguments against this or other companies, as occasion requires.

Mining companies, on the other hand, too often fail to help other employers, who may be faced with similar problems; hence, their exhibits and arguments may be in sharp conflict, and innocently work hardship on the other fellow. If memory serves, I recall one case where references made by one or two operators to the "Mexican rate" and the "Anglo rate" led to a long investigation by the Commission of alleged discrimination involving several companies.

Realize, too, that unions are big business. Mr. Leary, treasurer of the Mine, Mill and Smelter Workers Union, tells me that more than one million dollars passes through his hands annually, and his is not a big union. If you don't believe it, this union's financial reports are published and are easily accessible. In other words, the union can today finance any legal fight they get into if they think it worth while, and they are not likely to be frightened by the company's balance sheet.

Sixth: Too often, I think, companies take a paternalistic attitude toward unions, and brush aside the suggestions of the men as childish. Eric Johnston has pointed out effectively the fallacy of not treating the union as an equal. In one of the first cases I ever listened to, the company bitterly opposed the

DON'T UNDERESTIMATE THE UNION'S STRENGTH

appointment by the union of a safety committee, whose duty it would be to meet with management and discuss working conditions in the mine. Admittedly ignorant as I was on the subject, it just never appealed to my sense of logic for any company to think that the men who had to run the risk of injury should not at least be given an opportunity to be heard on the subject of safety.

It is encouraging, when you see what can occur when the company and the union work together on a subject of this type, where the best interests of both are identical. An example was revealed in a recent case. In the past, the company in question considered, as a matter of policy, that its plans to correct dust hazards at its property were the exclusive interest of the industrial engineering department and of top management. However, in recent negotiations, the company proposed a labor-management committee to study the dust problem and to develop joint solutions and progress reports, in exchange for which the union withdrew its demand for a dust differential in wages. The realistic approach of this company resulted in the saving of thousands of dollars in wage increases, and in improved labor responsibility and morale of incalculable value to the company.

Seventh: Don't be an Indian giver! This may be hard to swallow, when you gave in the first time only because of governmental directive; but nevertheless I think you can state your dislike of a principle without at the same time making the union feel you are going to battle to take it away from them the next time it comes up. The best example I can think of is "union security." The policy of the WLB is now so well established on this subject that its inevitability should be recognized without question. It is not surprising that a major cause of mining labor troubles has been failure of management to renew voluntarily a union security provision after it has once been ordered by the Commission or the National War Labor Board.

Nothing makes a union so uncooperative and suspicious as a management refusing to help maintain union membership. Labor interprets such an attitude on the part of management as a threat to its security, which has the effect of beclouding all future collective bargaining between the parties. Louis Brandeis, late Supreme Court Justice, once said that the giving of responsibility creates responsibility. If management will help a union maintain its membership, it may well find that it has thereby furthered the development of a responsible and businesslike union that will respect its contractual obligations. I know some companies that certainly think so, anyhow.

GET SAM OUT OF THERE AND PUT THAT LOADER TO WORK

Eighth: Don't let George do it! Or, maybe I should say, Don't let Uncle Sam do it! What I have in mind here applies equally to both sides, but, to me, it is the company that usually pays when issues that should be settled through collective bargaining are tossed into the necessarily long-drawn-out lap of governmental procedures. Why? Well, obviously, discontented restless labor will reduce production; and just as obviously, management has forfeited its right to have a voice in forming its own labor policies; and, of course, if the union wins in the end, the award is likely to be retroactive in effect.

In each of four cases heard in recent months more than forty issues were in dispute. The hearing and deciding of these mountains of trouble would necessarily have taken months. Fortunately—and I say it advisedly—the Commission has a competent mediation officer, who went to the scene of the difficulty, and, in each instance, was able to get the parties to do the thing that they should have done in the first place, which was to engage in collective bargaining. The result was that the Commission heard only about a half dozen issues in each case. Perhaps Governor Dewey's recent plea for restoration of collective bargaining, free of the labyrinth of War Labor Board procedures, might be more easily granted if labor and management would do their darndest to reach an agreement before bringing Uncle Sam into it.

Ninth: "What is it going to cost me?" not "What can I expect out of it?" is too often the cry of some companies; and how you can see labor bristle when every one of its demands is re-evaluated by the company's representative in terms of dollars and cents. No one denies the importance of this approach, but it should be remembered that it is not the all-embracing approach, no more than it is when you are discussing with your wife the rearing of your children. To formulate policy on a strict dollars and cents basis often gives labor the impression that the companies are trying to exploit labor and are not interested in genuine improvement of labor conditions.

Most authorities, I think, are in agreement that, since the first World War, a great advance has been made in the field of personnel management, which advance has been based upon the theory that labor is not a commodity, but rather a group of human beings whose rate of production would increase or decrease, dependent upon the character of their working conditions. I have observed that those companies in the nonferrous industries who have the best production records and the lowest unit costs are also those companies who have voluntarily granted, within wage stabilization principles, the best possible wages and working conditions to their employees.

Tenth: "Your left hand should know what your right hand is doing."

If not, you may find that you are shadow boxing with yourself. To my mind, one of the great sources of labor disputes is the establishment of a policy by management against the development of uniform collective bargaining clauses in contracts for various branches of the company. A parallel condition causing labor disputes is the insistence by management that the central office of the company must approve every concession to the union; or, at the other extreme, the policy of management to allow branch executives to grant concessions that they deem advisable without safeguarding the over-all policy of the central office of the company.

It is my belief that an over-all company policy on labor conditions, which establishes reasonable limits within which branch managers may negotiate with labor without violating central office policy, would greatly reduce the number of labor controversies and the seriousness of others.

Classify Jobs Fairly

For an eleventh point, I would like to suggest, "I'm a better man than you are, Gunga-Din." That, of course, just means the ever-present job-classification problem. It seems more than just a coincidence that in practically every case that comes before us, there are classification issues, some simple but some that would perplex a Solomon. Again, looking at this from the management angle alone, I have been struck by the almost monotonous regularity with which the sole argument of the company is that of, "This has been our classification system since the year 1, and to change it now would wreck our whole organization." This is indeed a potent argument, and deserves great weight, but it should be realized that almost invariably, when it is raised, the men can, or feel they can, point to some chap at an adjoining property who is doing identical work and is receiving more money for it by being rated differently. Hence the company's argument fails to impress the employee who thinks he is misclassified and underpaid.

To say that a miner is always a miner, a mucker is always a mucker, a laborer is always a laborer, or a mechanic is always a mechanic, no matter where you find him, is just not the fact. Miners: machine, contract, stope, raise, drift, development, etc., etc. Muckers: some mines have them, some don't. Laborers: some have them underground, some don't, some have as high as five types in one operation, all at different rates, while others not far away have but one.

It is when you talk about mechanics that you really are in trouble, for you have operations that recognize a single mechanic rate (with perhaps a helper or apprentice rate), running next door to mines that have master mechanics, special mechanics, mechanics, first, second, and third class, then specialists, then mechanic's helpers, first, second, and third class, and so on.

Too often have single classification rates been set solely on the basis of individual bargaining, or to appease a strategically situated minority group of skilled workers. Such compromise deals may settle the problem for a time, but are likely to be skeletons in the closet, which will rise up to haunt management in the future. Even when such arguments are referred to arbitration, they may prove real headaches to management, as is illustrated by a recent award in this industry, to which the employers have strenuously objected.

To my lay mind, a scientific wage scale, worked out by industrial experts, whose study is agreed to in advance by collective bargaining, may be the best solution. In some instances, I have known unions which have agreed to pay one-half the cost thereof. In some cases I have known, the company's own classification system, based on proper job study with adequate and understandable descriptions thereof, has been heartily indorsed by the union. After all, a discontented individual is a hard person for even the union to handle.

Last year, the Commission, by way of experiment, hired an outstanding graduate engineering student to check, with a few companies and unions, classifications at certain operations just to see the general picture. In one case, where the union was complaining loudly about three particular jobs as being underpaid, the young engineer, applying the latest scientific technique, studied the situation and found, in two out of the three jobs, the men were receiving more than their duties and responsibilities entitled them to, while in the third case, the rate was less than a few cents below its proper scale. Suffice it to say, the union immediately dropped its entire demand for reclassification.

Frankly speaking, it is difficult to justify a company's assertion that it has a correct and scientific wage scale where, as in several cases, we have been asked to approve a vast number of classifications for a mine with a small payroll. I recall one case in which the mine regularly employed approximately twenty persons, all told, yet sought approval of more than forty classifications. So again I say, improper classifications are the source of many, many labor headaches.

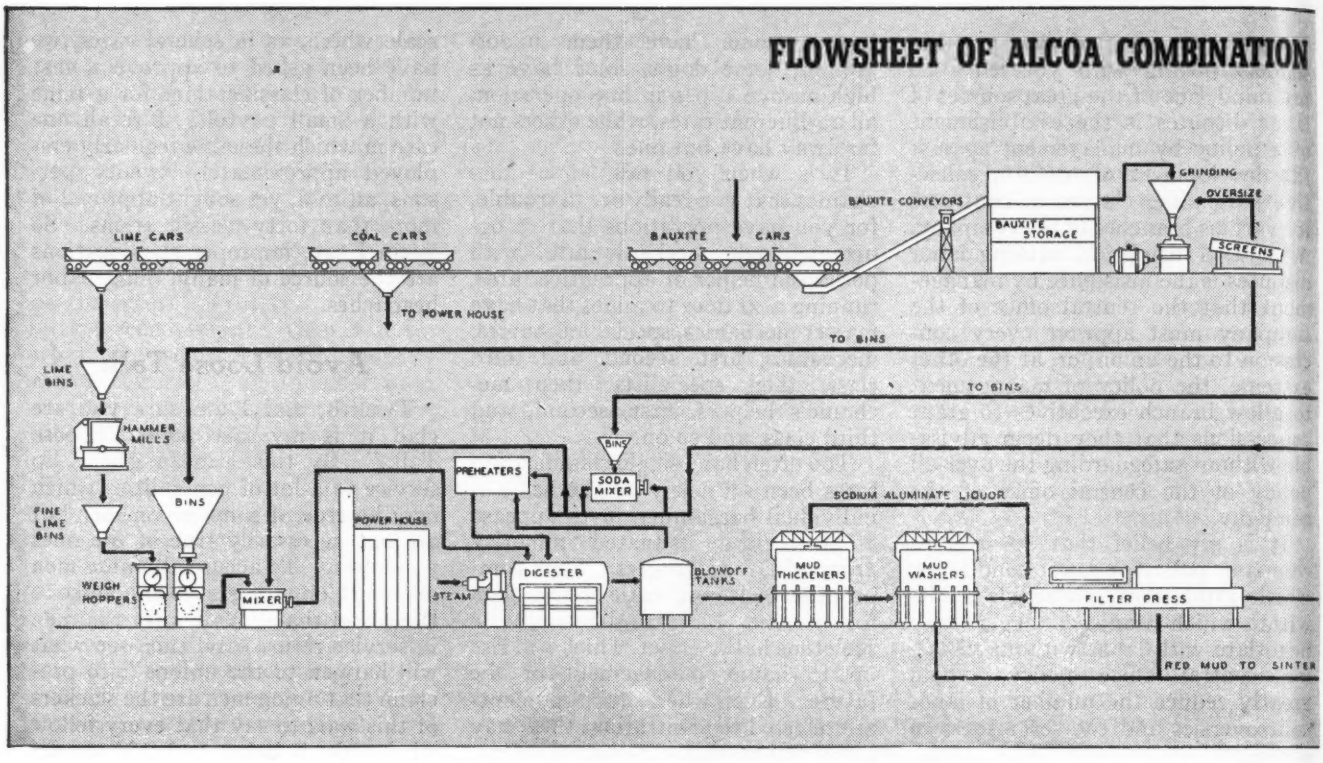
Avoid Loose Talk

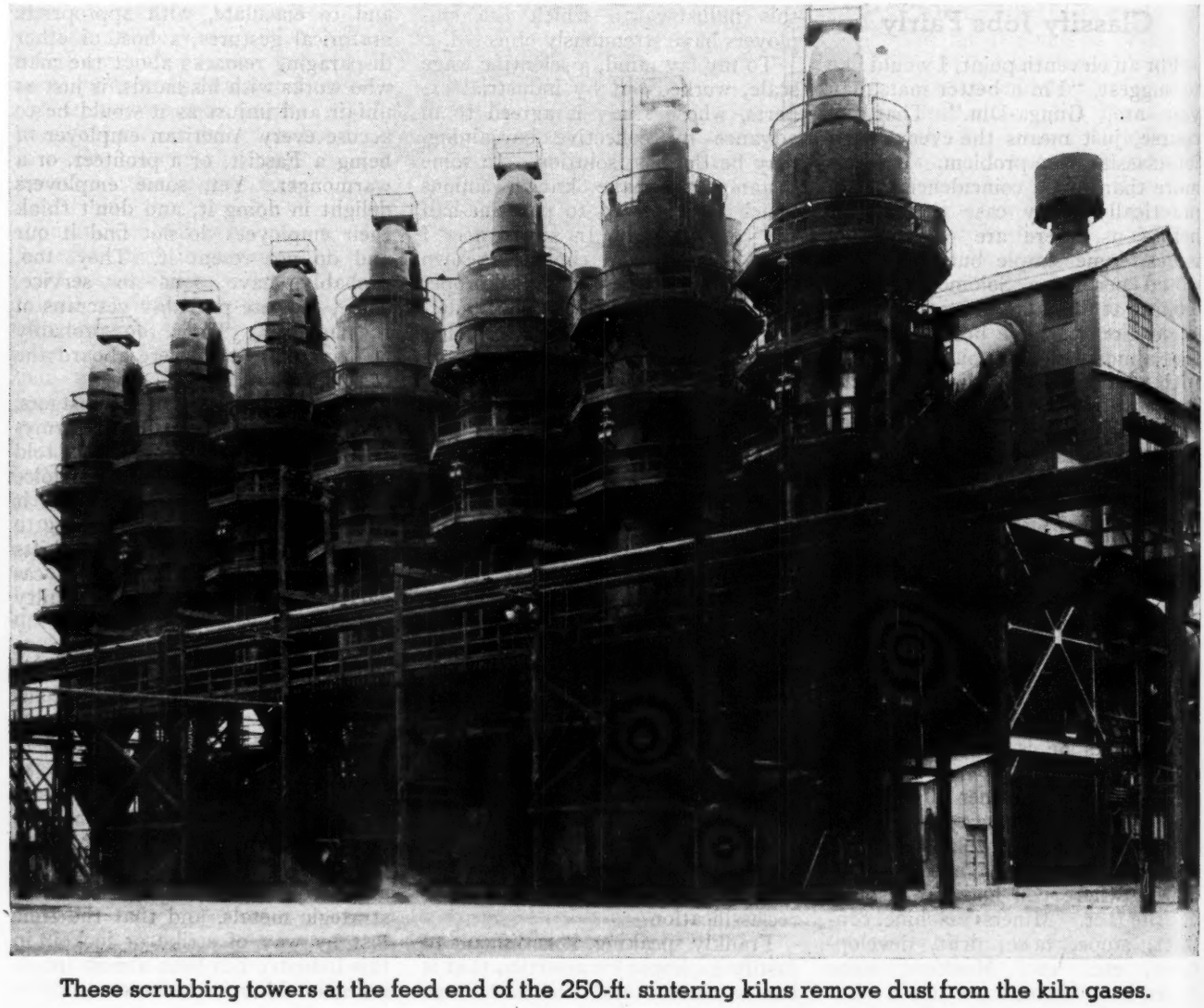
Twelfth, and I am sure you are glad it is my last point: "Loose Talk." By this I mean giving lip service to a lot of generalities which may be true of some union men but are not necessarily true of the ones you know. To accuse all union men of being Communists; to announce to the world that "Wait until the men in service return, and then see what will happen to the unions"; to proclaim that union men are the slackers of this war; to say that every fellow who works is being overpaid; to denounce all union leaders as racketeers, and to ejaculate, with appropriate oratorical gestures, a host of other disparaging remarks about the man who works with his hands, is just as unfair and unjust as it would be to accuse every American employer of being a Fascist, or a profiteer, or a warmonger. Yet, some employers delight in doing it, and don't think their employees do not find it out and do not resent it. They, too, probably have sons in service. They, too, are probably veterans of the last war. They, too, probably had ancestors who were aboard the Mayflower.

One of my favorite managers, whose smelter proudly flies the Army-Navy "E" with two stars, once told me with real emotion in his voice that they never could have done it if 'his boys" hadn't been willing to work double and even triple shifts to keep the plant going at full capacity. I'll venture he is not guilty of loose talk.

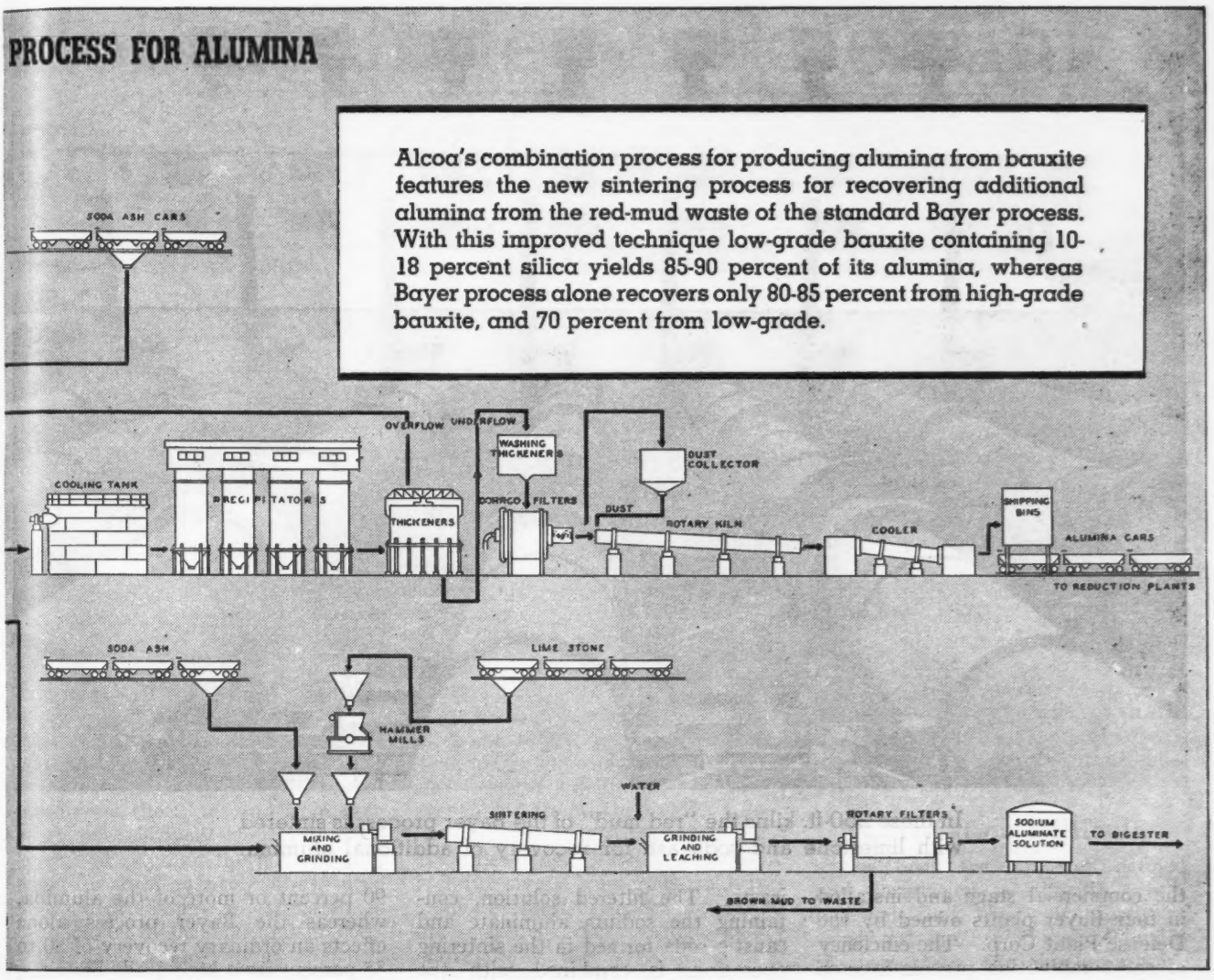
* * *

I do not want to close this article without expressing my personal admiration for the way both management and labor have cooperated in producing non-ferrous metals, so essential to the war effort. I have marveled at and applauded the way the two groups have worked together, so that, today, we are actually acquiring stockpiles of these strategic metals, and that the time lost by way of strike or lockout in this industry has been almost infinitesimal. May it continue!





These scrubbing towers at the feed end of the 250-ft. sintering kilns remove dust from the kiln gases.


PROCESS FOR ALUMINA
Alcoa's combination process for producing alumina from bauxite features the new sintering process for recovering additional alumina from the red-mud waste of the standard Bayer process. With this improved technique low-grade bauxite containing 10-18 percent silica yields 85-90 percent of its alumina, whereas Bayer process alone recovers only 80-85 percent from high-grade bauxite, and 70 percent from low-grade.
SODA ASH CARS
OVERFLOW
UNDERFLOW
WASHING THICKENERS
DUST COLLECTOR
COOLING TANK
PRECIPITATORS
THICKENERS
DORRCO FILTERS
DUST
ROTARY KILN
COOLER
SHIPPING BINS
ALUMINA CARS
TO REDUCTION PLANTS
SODA ASH
LIME STONE
HAMMER MILLS
WATER
SINTERING
MIXING AND GRINDING
GRINDING AND LEACHING
ROTARY FILTERS
SODIUM ALUMINATE SOLUTION
TO DIGESTER
BROWN MUD TO WASTE

More Alumina From Bauxite By Sintering "Red Mud"

THE MOST SIGNIFICANT IMPROVEMENT in the Bayer process for the production of alumina from bauxite is the wartime development by the Aluminum Company of America of the Alcoa combination process. Its technical feature is the re-treatment of the "red mud" waste resulting from the Bayer process. Its economic importance is twofold: it recovers additional alumina, and it makes possible the utilization of low-grade, high-silica bauxites, of which there are substantial reserves in this country.

In the Bayer process (*E.&M.J.*, Sept. 1943), commonly used throughout the world for refining bauxite, the mineral is digested under pressure with hot caustic soda solution, which dissolves the alumina and leaves the impurities—iron, silicon, titanium—as an insoluble filter residue known as "red mud." Because each pound of silica in this residue causes a loss of one pound each of alumina and soda, as insoluble sodium aluminum silicate, it has been desirable to use high-grade, low-silica bauxite. But such bauxite, containing less than 7 percent silica, has not been freely available during the war; and the more plentiful low-grade domestic ores contained about 13 percent silica. The use of the latter in the Bayer process being wasteful of materials, manpower, and equipment, it became necessary to modify the standard process if low-grade ores were to be used.

A laboratory process for recovery of both alumina and caustic from Bayer plant waste, which had been developed by Aluminum Research Laboratories, was quickly brought to

In these 250-ft. kilns the "red mud" of the Bayer process is sintered with limestone and soda ash for recovery of additional alumina.

the commercial stage and installed in four Bayer plants owned by the Defense Plant Corp. The efficiency of the combination process is such that the proportion of alumina recovered from high-silica bauxite is higher, and the soda loss lower, than in the old Bayer process treating high-grade bauxite.

In the new process the "red mud" is mixed with ground limestone and soda ash, and sintered in a kiln at a temperature of 1,800 to 2,000 deg. F. to break up the sodium aluminum silicate. The limestone and soda ash are adjusted in amount so that there is a slight excess of lime over that necessary to combine with the silica to form dicalcium silicate, and a slight excess of soda over that necessary to form sodium aluminate with the alumina. The 250-ft., coal-fired kilns contain festoons of chains at the feed end, which break up the slurry as it dries and prevent the formation of balls and rings.

The soft, friable sinter is then ground and leached with water to produce a solution of sodium aluminate and caustic soda containing the major part of the alumina and soda in the "red mud." After filtering and washing, the residue—now known as "brown mud"—is run to waste. The filtered solution, containing the sodium aluminate and caustic soda formed in the sintering operation, is combined with the spent liquor of the standard Bayer process and returned to the digesters for the treatment of fresh bauxite. The sintering and leaching operation does not effect complete separation of silica, and a small part passes back to the digesters, possibly in colloidal form, where it again passes into the "red mud" with the insoluble portion of the bauxite charge.

High Efficiency Obtained

The remaining steps in the process follow standard Bayer practice. The clear solution of sodium aluminate is sent to precipitation tanks, where, by "seeding" with aluminum trihydrate and by slow cooling and agitation, crystalline aluminum trihydrate is formed. This product is filtered, washed, and calcined to produce the pure alumina necessary for electrolytic reduction to aluminum. The spent liquor, containing caustic soda and some alumina, is returned to the digesters.

By such a cyclic process it is possible to treat bauxite containing 10 to 18 percent silica and recover 85 to 90 percent or more of the alumina, whereas the Bayer process alone effects an ordinary recovery of 80 to 85 percent from high-grade bauxites, and only 70 percent or less from low-grade ores.

The new alumina development laboratory of Aluminum Research Laboratories, built at a cost of $750,000 at the East St. Louis (Ill.) works of Aluminum Ore Co., provides pilot-plant equipment for the development of improved operating technique, economy in use of materials, and improved quality of product in the Alcoa combination process for the treatment of low-grade bauxites. The equipment reflects on a small scale that actually used in the commercial process. It is so arranged that it can be connected into complete layouts for any alkaline-digester or sinter process, or combination of these processes, to handle any type of raw material. Built primarily for the purpose of speeding production of aluminum and conserving materials and manpower for the war effort, the laboratory will be of future benefit in improving and developing methods of extracting alumina from materials not now usable, thus expanding national reserves of available ore.

Hobart Butte—A Potential Source of Alumina

H. G. IVERSON, *District Engineer, and* **G. P. COUGHLIN,** *Mining Engineer, Western Region, U. S. Bureau of Mines, Portland, Ore.*

DIAMOND DRILLING has disclosed the presence of a large body of high-grade refractory clay at the top of Hobart Butte, in Lane County, Ore. The U. S. Bureau of Mines, which did this exploration work in 1943, estimates that the deposit contains 13,000,000 to 14,000,000 tons of clay running approximately 29.3 percent in available alumina and 3.2 percent in ferric oxide. Much of this tonnage will average between 30 and 31 percent available alumina. The overburden is put at 2,000,000 to 3,000,000 tons. In addition, at least two large bodies of lower-grade material were found beneath the one just described, which are separated from the latter and from each other by relatively thin, low-grade layers. Excluding the inferred tonnage, the total quantity of measured and indicated clay is estimated to be between 27,000,000 and 30,000,000 tons averaging about 26.9 percent in available Al_2O_3 and 4.5 percent in ferric oxide.

Long Known

Hobart Butte is about 16 miles south of Cottage Grove. It has been known locally as a source of high-quality refractory clay for a number of years. Since 1934, 12,000 to 15,000 tons has been mined.

Because of the attractive possibilities of making refractory products from Hobart Butte clay, it was investigated prior to 1938 by the Oregon State Department of Geology and Mineral Industries and the U. S. Bureau of Mines, and by the University of Washington.[1] Samples were found to be highly refractory, fusing between cones 32 and 34, and containing 38 to 40 percent of alumina.

In 1942 attention was directed to the Butte as a possible source of alumina. A large number of samples were collected from exposures in a quarry and elsewhere on it. Favorable results were obtained, which led to extensive diamond drilling by the Bureau of Mines. Representatives of the U. S. Geological Survey[2] aided the Bureau of Mines during the preliminary work and the diamond drilling.

The Butte stands about 1,500 ft. above the valley floor, rising sharply to a maximum altitude of 2,459 ft. Its sides are steep and wooded. From a width of about $\frac{7}{8}$ of a mile at its base, it tapers to about 100 ft. in a narrow ridge at the crest. The quarry exposing the high-grade clay is slightly below the top and is accessible from the valley floor by a narrow, steep mountain road 2.8 miles long. The clay exposure is impressive. Numerous small pits along the crest excavated by earlier investigators also expose high-quality material.

In testing the samples, the Bureau of Mines, besides making chemical analyses, determined the percentage of alumina that could be extracted by acid processes; this was designated as "available alumina." Usually it exceeded 90 percent of the total alumina content.

Intensive diamond drilling was necessary to get accurate information about tonnage and grade. This was begun in January 1943 and completed late in October of that year. Forty vertical holes 70 to 521 ft. deep and totaling about 10,000 ft. were drilled. Excepting ten reconnaissance holes, they formed a more or less uniform pattern on the crest and upper sides of the butte over an area 1,200 ft. wide and 2,500 ft. long.

The deposit consists of bedded waterlaid sediments, including breccia, conglomerate, sandstone, and shale. They are highly altered, so that it was often impossible to determine their exact texture. Angular fragments up to 1 in. long occur in the breccia, and white, ovaloid, clay pellets up to $\frac{1}{2}$ in. in length are prominent in much of the breccia and conglomerate. Realgar and stibnite were found in some cores and the former can be seen in the quarry face. Material containing these minerals was invariably high in available alumina. At least part of the deposit has been hydrothermally altered. Some of the ore is iron-stained and contains small veinlets of iron oxide. Realgar suggested cinnabar, so much of the core was tested with an ultraviolet light and willemite screen. No substantial indications of mercury were noted, however.

Correlation Difficult

The beds are not well defined and correlation is difficult. It is believed that they dip north or northwest at 10 to 30 deg. The dip is steepest at the northeast end, which section has apparently been shifted by faulting. Within apparently the same bed the content of available alumina often varied from one place to another.

Difficulty was experienced in getting a good recovery of water from some of the holes. Fractured zones or porous ground was often encountered, through which all of the water was lost. A technique involving the use of equal quantities of bentonite and rolled barley was found to be the most successful. As much as 8 to 10 ft. could be drilled after each application. Sealing the holes thus was inexpensive and removed the need of casing many bad holes.

Holes in highly fractured and loose ground from which core recovery was poor were cased and the sludge was collected from each 5-ft. interval. Sludge from easily drilled holes from which good recoveries of core and water were made was collected for each 25-ft. interval. Usually there were only small variations in the analyses of the sludge and the core.

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[1] Wilson, H., and Treasher, Ray C.: "Refractory Clays of Western Oregon." Bulletin 6, Oregon State Department of Geology and Mineral Industries.

[2] Dr. R. L. Nichols and J. S. Loofbourow, Jr., geologists.

Where Spirals Replaced Tables, Flotation Cells

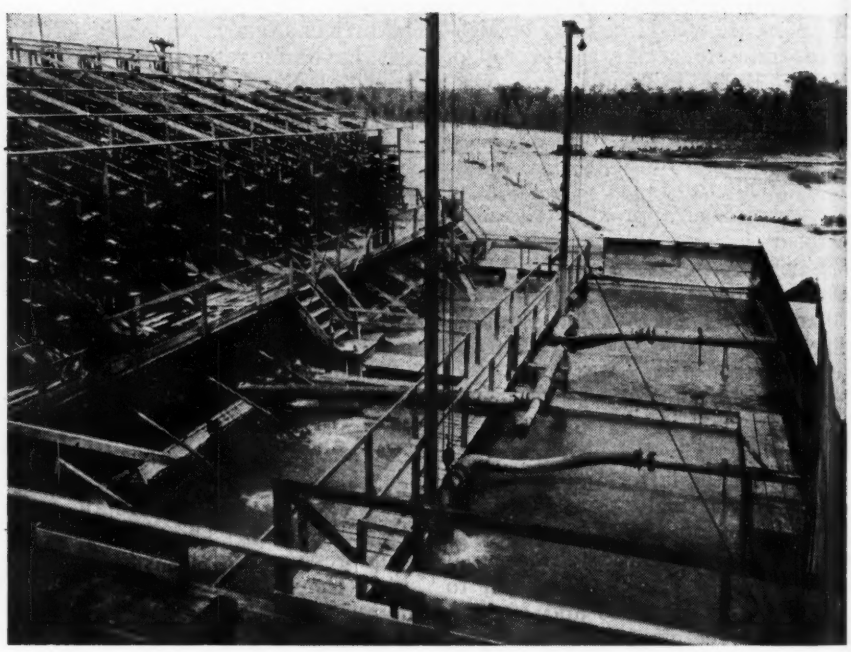
I. B. HUMPHREYS, *President, Humphreys Investment Co., Denver, Colo., and* **JUDSON S. HUBBARD,** *Secretary and Treasurer, Humphreys Gold Corp., Denver, Colo.*

TITANIUM MINERALS, in increasing demand for war uses, are being separated from about 5,000 tons of sand daily in a plant operated by Humphreys Gold Corp. near Jacksonville, Fla. Primary concentration is accomplished by Humphreys spirals, use of which has contributed materially to the position this plant holds as the largest producer of rutile in the United States and one of the principal sources of ilmenite.

First described in *E.&M.J.* for October, 1943, while they were in use in an Oregon chrome plant, the spirals have since been tested and applied in a number of operations. In the Florida plant, spirals replaced tables and flotation cells, and despite the large daily tonnage treated, the spiral plant requires on each shift only one operator and a helper and one pump man. Concentrating and accessory equipment occupy a space of 80 x 112 ft.; no walls or roof are required except over the pumps. Recovery of heavy minerals is over 95 percent, and this fraction makes up about 92 per cent of the concentrate. Feed to the spirals contains about 5 to 11 percent of heavy minerals.

The heavy mineral concentrate of the spirals is dried, then fed to an electrostatic and electromagnetic separation plant that produces a rutile and an ilmenite concentrate. This article will be confined, however, to presenting details of equipment and control of the spiral plant.

Rutile (TiO_2) is used principally as a coating for welding rods and in producing ferrotitanium for steel. Ilmenite ($FeTiO_3$) goes chiefly into pigments. An important and growing use for both is in production of titanium tetrachloride for smoke screens. Before the war, both rutile and ilmenite were imported, the former from Australia, the latter from India; but domestic sources, largely in New York and Florida, now meet the demand. Incidentally, Florida "ilmenite" is actually more like arizonite ($Fe_2O_3.3TiO_2$) in composition, being higher grade in TiO_2 than ilmenite.



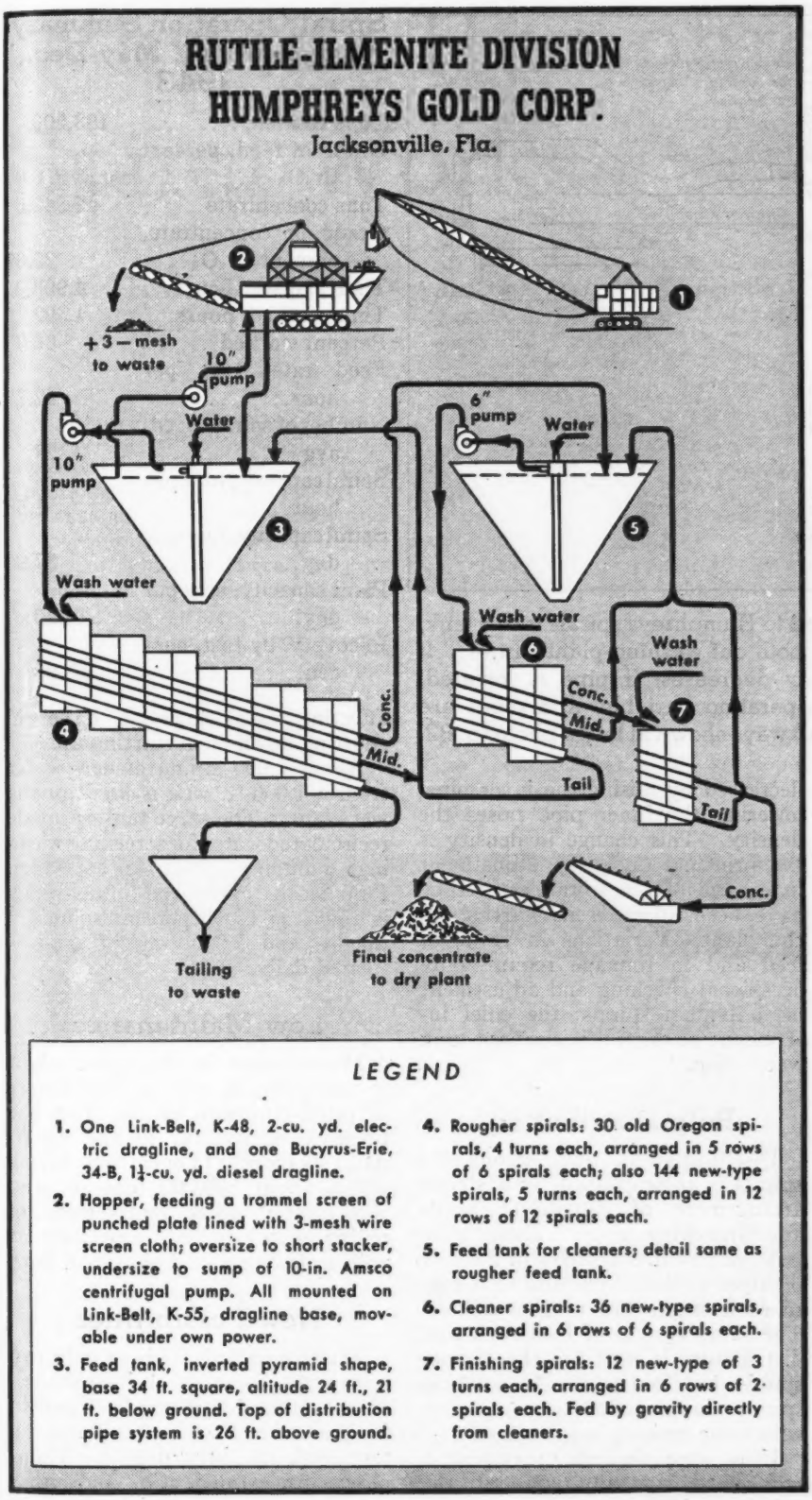
LARGEST U. S. PRODUCER of rutile and important source of ilmenite is this 5,000-ton plant near Jacksonville, Fla., now leased and operated by Humphreys Gold Corp. Spirals shown here make rough concentrate which is cleaned, then further refined in an electrostatic and magnetic plant. Tanks, in center, control feed pulp density. Nearest tank controls feed to cleaner spirals; farther tank controls feed to roughers at left. These are chief plant control elements.

Spirals in Oregon

The Humphreys spiral concentrator, invented by I. B. Humphreys, president of Humphreys Investment Co., Denver, Colo., was first used in gravity concentration of chromite from marine sands in Coos County, Ore., in a plant operated by Humphreys Gold Corp., of which A. E. Humphreys is president and D. G. Brown is general manager. Performance records on this job are given in an accompanying table; details of the concentrator were given in the article already cited.

Beginning operation in May, 1943, the Humphreys Oregon plant ran for seven months, producing a chromite concentrate that might have been of vital importance to the country had the war not soon thereafter taken a more favorable turn. Victory in the Mediterranean and satisfactory negotiations for Turkish chrome released enough of the mineral so that by December, 1943, Metals Reserve Co. had accumulated ample stockpiles of chemical chrome from abroad. Purchase contracts with Humphreys Gold Corp. and its neighbor, Krome Corp., were cancelled and the plants were shut down.

Concentration of the chrome sands with spirals was satisfactory from both economic and metallurgical standpoints; in fact, after close observation of the performance of


RUTILE-ILMENITE DIVISION
HUMPHREYS GOLD CORP.
Jacksonville, Fla.
+3—mesh to waste
10" pump
Water
10" pump
6" pump
Water
Wash water
Wash water
Wash water
Conc.
Mid.
Tail
Conc.
Mid.
Tail
Conc.
Tailing to waste
Final concentrate to dry plant
LEGEND
1. One Link-Belt, K-48, 2-cu. yd. electric dragline, and one Bucyrus-Erie, 34-B, 1½-cu. yd. diesel dragline.
2. Hopper, feeding a trommel screen of punched plate lined with 3-mesh wire screen cloth; oversize to short stacker, undersize to sump of 10-in. Amsco centrifugal pump. All mounted on Link-Belt, K-55, dragline base, movable under own power.
3. Feed tank, inverted pyramid shape, base 34 ft. square, altitude 24 ft., 21 ft. below ground. Top of distribution pipe system is 26 ft. above ground.
4. Rougher spirals: 30 old Oregon spirals, 4 turns each, arranged in 5 rows of 6 spirals each; also 144 new-type spirals, 5 turns each, arranged in 12 rows of 12 spirals each.
5. Feed tank for cleaners; detail same as rougher feed tank.
6. Cleaner spirals: 36 new-type spirals, arranged in 6 rows of 6 spirals each.
7. Finishing spirals: 12 new-type of 3 turns each, arranged in 6 rows of 2 spirals each. Fed by gravity directly from cleaners.

the Humphreys mill, the management of the nearby plant of Krome Corp. revamped their flowsheet by replacing original concentrating equipment with Humphreys spirals, which required about one-fourth former floor space, released several men, reduced cost of power and repairs, and improved metallurgy. In addition, feed to the spirals did not need to be deslimed, because a moderate amount of slime has no effect on the spiral's concentrating action.

Florida Plant Started

In March, 1944, three months after the shutdown, the whole Oregon plant of Humphreys Gold Corp., including shovels, screening and washing plant, 30 Humphreys spirals, pumps, pipe, concentrate-handling equipment, and motor trucks, was shipped across the continent 3,643 miles to the site of the new titanium concentrator about 9 miles east of Jacksonville, Fla. The purpose of this move was to supplement the established operation of the Rutile Mining Co. of Florida, a subsidiary of Titanium Alloy Mfg. Co., which had been producing ilmenite and rutile from nearby sand deposits. The sand had been mined by fixed-mast and mobile draglines, washed and screened in a skid-mounted trommel screen plant, then concentrated by tabling and flotation to remove silica. This product was dried and then separated into rutile and ilmenite fractions by electrostatic and electromagnetic equipment.

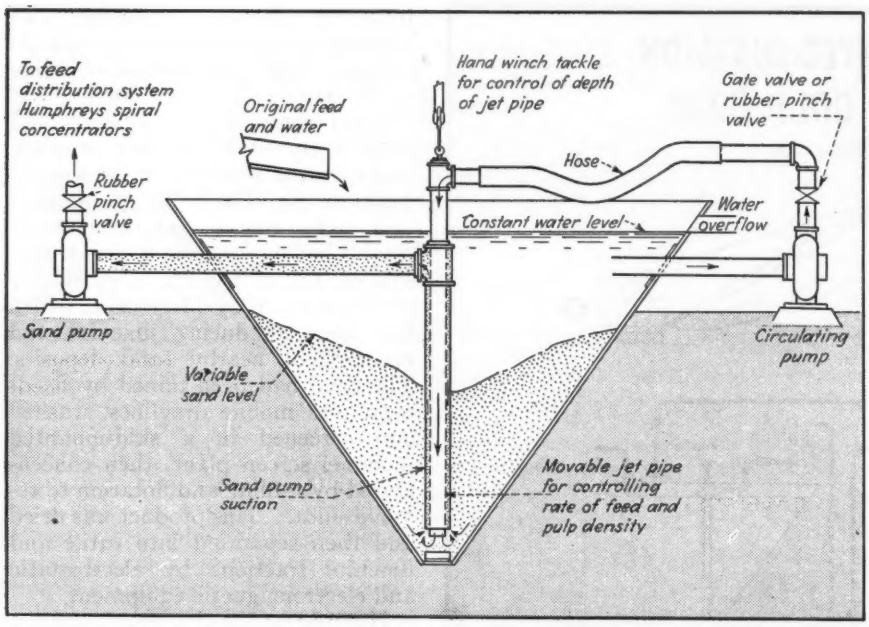
Humphreys Gold Corp., on April 1, 1944, leased all the property and equipment of Rutile Mining Co., and assumed full charge of operation. The excavating, screening, and washing equipment used in Oregon was substituted for that of the Florida company.

The table and flotation plant was run for a short time, pending installation of the 30 Oregon spirals and 192 additional spirals, but when the spiral plant was ready, tabling and flotation were abandoned completely. Concentrate of the spirals is dried and fed to the electric plant as formerly.

The new plant now uses 174 rougher spirals, 36 cleaner spirals, and 12 finishing spirals. These are arranged as shown in the flowsheet and as given in the list of equipment. The 30 spirals from the old Oregon plant now serve as roughers, together with 144 spirals of a later model. The newer spirals have five turns instead of four and they are built in a tighter spiral than the older model, which means that they occupy even less floor space. An accompanying picture of the new spiral shows it in operation.

Spiral Control

Feed to the spiral, or wet plant, as it is called, contains amounts of heavy minerals varying from 5½ to 11 percent, most of which are found in the finer sizes. The product delivered to the dry mill has been consistently maintained at about 92 percent of heavy minerals, with an outside variation in recent months from 88 to 96 percent of heavy minerals. The percentage of recovery in the spiral plant of the valuable rutile and ilmenite con-


To feed distribution system Humphreys spiral concentrators
Original feed and water
Hand winch tackle for control of depth of jet pipe
Gate valve or rubber pinch valve
Hose
Rubber pinch valve
Constant water level
Water overflow
Sand pump
Circulating pump
Variable sand level
Sand pump suction
Movable jet pipe for controlling rate of feed and pulp density

CONTROL SYSTEM for density of feed to Humphreys spirals is this tank, which also acts as storage tank to smooth out washing-plant surges. If jet pipe is raised, feed pulp density decreases; if pipe is lowered, density goes up. Density is chief operating variable, and pipes are shifted by hand winches on spiral walkways shown at left in photo, p. 82.

tained in the feed is over 95 percent; about 2 percent of the nonvaluable heavy minerals is eliminated as spiral tailing. Screen analysis of the feed, all minus-3 mesh, runs about as follows:

Size	Percent Wt.	Material
+40 mesh	0.07	Quartz & organic
−40 + 60	1.26	Quartz & organic
−60 + 80	37.75	Quartz & organic
−80 + 100	41.11	Quartz & heavy
−100 + 120	14.61	Quartz & heavy
−120 + 140	1.61	Quartz & heavy
−140 + 200	3.08	Chiefly heavy
−200	0.56	Chiefly heavy
	100.05	

Most important elements in control of the spiral plant are the feed tanks—one to receive washing plant product and one to receive rougher concentrate. Both these tanks act as surge as well as feed tanks, and they have been built large enough to provide ample storage space for intermittent delivery from the digging and washing equipment.

As shown in an accompanying drawing, pulp is removed from these tanks through two concentric pipes set vertically just above the points of the tank bottoms. The inner pipe can be raised or lowered by a hand winch on the spiral floor. Water is pumped down the inner pipe, and a suction pump lifts the agitated pulp through the annular space between inner and outer pipes and delivers it to the spiral distribution system. Pulp density is decreased by raising the inner pipe; lowering the inner pipe raises the density. This change in density is the principal operating adjustment in control of the spirals after they have been adjusted in starting up the plant. Variations in grade of feed and in tonnage require only occasional checking and adjustment of individual spirals; the chief instrument of control is the feed-tank water pipe.

Pulp Distribution

Distribution of pulp among the spirals is accomplished by a simple arrangement of distributor heads and branching pipes. These splitters are repeated a sufficient number of times so that a uniform feed goes to each of the 174 rougher spirals. The same system of feed tank and distributors is used for the cleaner spirals, but feed to the 12 finishing spirals flows directly by gravity, with some makeup water added.

If it were desired to run at a reduced tonnage, any number of the spirals could be shut down simply by closing the valves in their feed lines. The feed would then be automatically and accurately distributed among the remaining spirals. In the Florida operation feed lines to all spirals are left open; then when the feed tanks are pumped empty of sand, the circulating pumps are shut down until sand is again available. This can be done without affecting spiral behavior, either in shutting down or in starting up.

About 2,000 g.p.m. of new water from a 1,000-ft. well is used by the wet plant. The surge tanks provide recirculated water for screening washing, pumping, and concentrating. Pulp density of the feed to the spirals is about 25 to 30 percent solids by weight, and 5,000 tons of sand is treated daily.

Spiral Operation Summary. Oregon Plant, May-Dec., 1943

Tons treated	183,500
Grade of feed, percent Cr_2O_3	est.avg. 6.0
Tons concentrate	42,842.6
Grade of concentrate, percent Cr_2O_3	25.67
Time elapsed, hours	4,963
Time worked, hours	4,302
Percent worked	86.7
Feed rate, tons per hour	42.7
Number of spirals used, avg	27
Spiral capacity, tons per hour	1.58
Spiral capacity, tons per day	37.9
Plant capacity, tons per day	1,020
Recovery, by test, percent	92–98

Low Maintenance

Maintenance in the spiral plant is negligible, in spite of the danger of rapid corrosion arising from the presence of sulphur in the water. After six months of operation, during which about 800,000 tons of sand was treated, some replacement of piping was required, especially at points of change of direction of flow.

New Possibilities

There have thus far been only two large-scale commercial installations of the Humphreys spiral, those in Oregon and in Florida; but promising test work has been done by Humphreys Investment Co. and other agencies on many materials. Among them are: fine anthracite and bituminous coal, chrome ores, Mesabi iron-ore washer tailing, lead-zinc-gold-silver ore, tungsten ore, vermiculite, tin ore, and various ores of mica. A small plant near Salida, Colo., now uses the spiral to separate lepidolite and microlite, and other plants have been reported as testing or using spirals.

Why the Humphreys Spiral Works

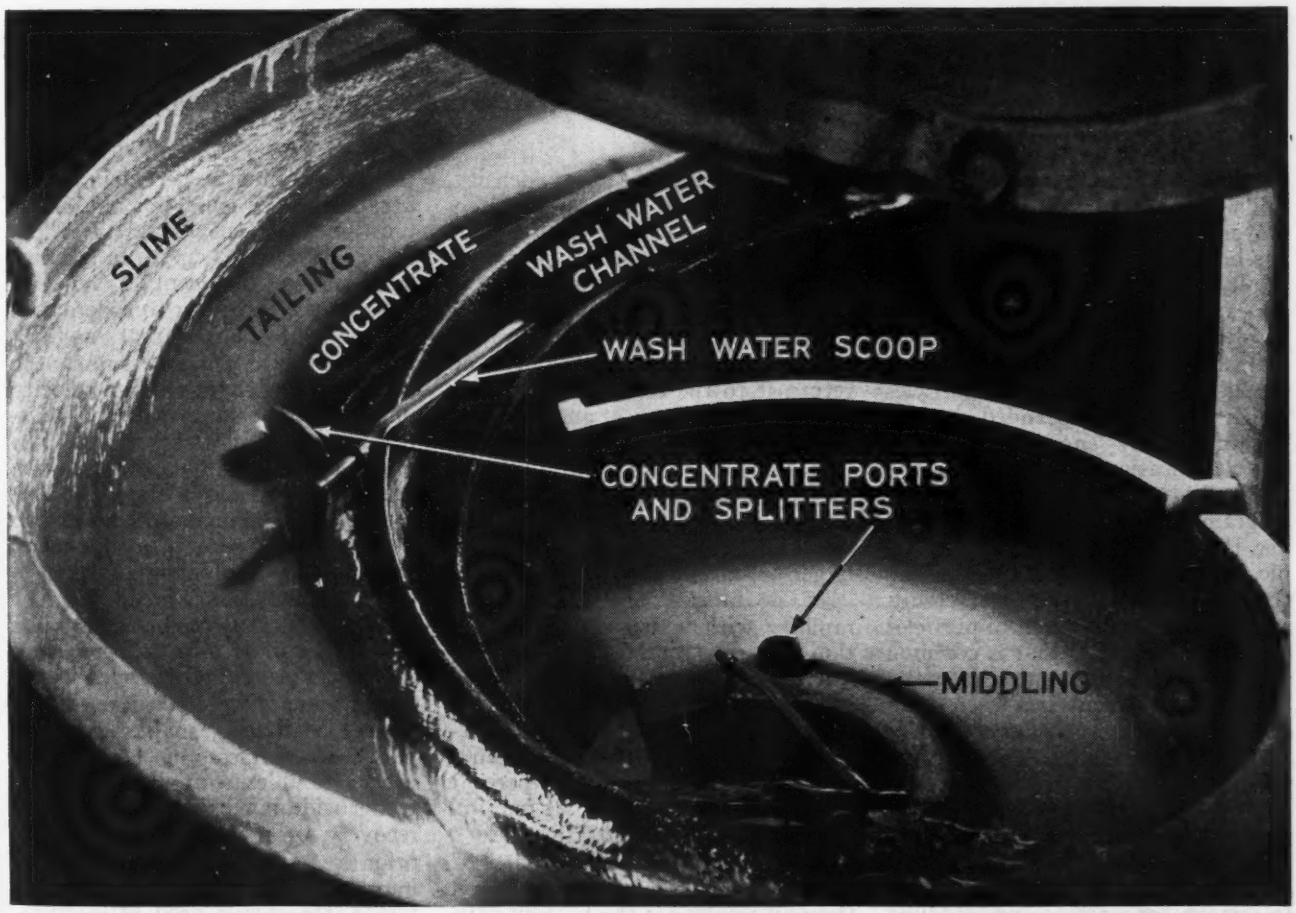
GEORGE W. GLEESON, *Acting Dean, School of Engineering and Industrial Arts, Oregon State College, Corvallis, Ore.*

EXAMINATION of the theory of operation of the Humphreys spiral concentrator indicates why a device of such simplicity is capable in certain instances of a higher efficiency than more elaborate equipment.

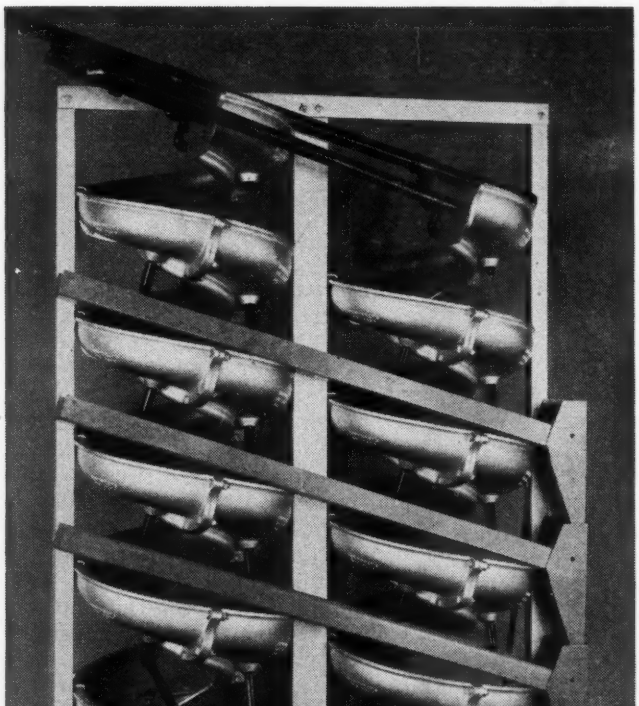
As water flows down the spiral channel of modified semicircular section, each element will be subjected to a centrifugal force, tangential to the channel, directly proportional to the square of the velocity of flow and inversely proportional to the radius at which the element is located. This centrifugal force piles water up on the outer rim of the spiral until the flowing stream reaches an equilibrium between centrifugal force outward and gravitational force downward. Once established, the position of the stream is fairly constant for uniform pitch and radius.

Velocity of the spiral stream decreases with depth from its maximum just below the water surface, until it approaches zero velocity at contact with the channel. The largest percentage decrease in velocity will occur nearest to the channel contact, giving rise to the "fluid film" concept that is well developed in hydrodynamic literature.

In any curved channel, whether a pipe or a river bed, the bottom layer of water, retarded by friction, has much less centrifugal force and consequently will flow sidewise along the bottom toward the inner bank of the curved channel, carrying with it the heavier particles of sand. Simultaneously with this bottom flow of water inward, the upper mass of water must flow outward to replace it. There is, consequently, besides the flow of water down the length of the spiral, a flow of decreasing velocity downward and across the channel to the inside, then upward and across the channel to the top, progressively increasing in



CONCENTRATING ACTION of spiral. Note wide black band of concentrate entering upper outlet, which is set for a wide cut; also narrow black band of middling entering lower outlet set for thin cut.



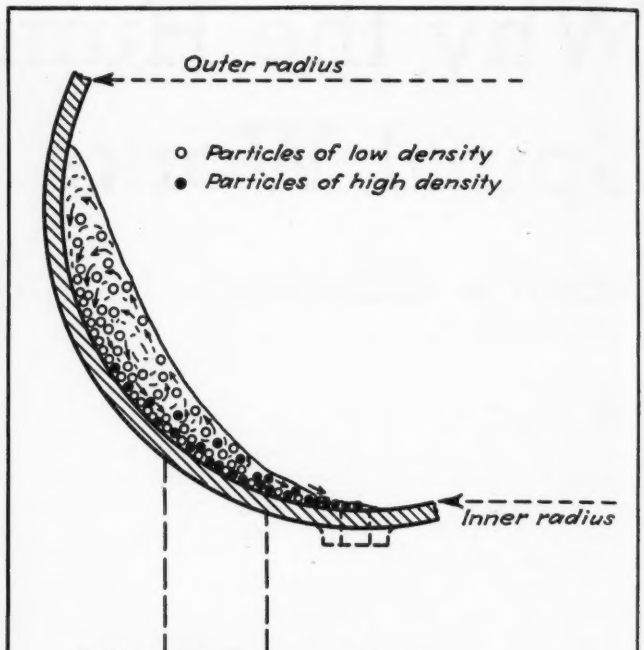


Fig. 1 . . . Showing how water flow along spiral bottom brings heavy mineral to concentrate outlets; reverse flow above carries lighter mineral up.

SPIRAL UNITS are arranged like this, usually with five complete turns in each roughing unit. Concentrate launders are at top; tailing launder at bottom. Wash water trough is on inner side of spiral.

velocity until friction again enters.

The foregoing rather complicated movement of the flowing stream has been well established as existing at all bends, and the spiral is simply an exaggeration of the more commonly encountered case. The several flows and forces combine to sort and concentrate any particles which may be suspended in the stream. Oddly enough, a limited size classification also takes place.

Fig. 1 is a highly conventionalized diagram of a section of the spiral and the flowing stream. The "double spiral action" in the flowing stream produces, as a final result, an idealized arrangement of particles of variable densities that is common to flowing-film type concentrators.

The arrangement has been indicated in Fig. 1 as concentrate, middling, and tailing. Particle size, within limits, is not a critical factor, and no particular advantage is gained by prior classification. Once the idealized arrangement has been established, it is a simple matter to remove concentrate and middling through suitable openings located near the inner radius of the spiral.

For particles of lower density, which sometimes are not entirely lifted into the main stream at the inner radius of the spiral, wash water is added at the inner edge of the stream. This wash water tends to wash off lighter material riding on the surface of the heavier and return it to the concentration zone. Adjustment of amount and direction of wash water and of a small deflection splitter, which is attached at each concentrate outlet, are the only controls required to produce a higher- or lower-grade outlet product in larger or smaller amount.

It is interesting to note the rapidity with which the concentration pattern is established. In operation as a rougher unit upon chrome-bearing sands, a concentration ratio of 2.31 to 1 was established in three-quarters of a revolution of the spiral and with a recovery of 58.4 percent of values at this point. At one full turn (second concentrate outlet), the concentration ratio was 2.07 to 1 at 90.7 percent recovery. Over-all results for the battery gave a concentration ratio of 2.25 to 1 at 98 percent recovery. Records for a seven-month period indicated a capacity per spiral for the above unit of 37.9 tons of raw feed per 24-hr. day, based upon an average head grade of 6 percent Cr_2O_3.

From the foregoing considerations it might be inferred that, as with tables, surface roughness and the corresponding change in film velocity might be important variables. Experience does not bear this out. It is presumed that the bedding of the solid particles along the bottom of the channel, and their motion relative to the water stream, control the bottom "roughness"; hence, artificial roughness is ineffective.

Finally, it might be mentioned that the spiral units are not particularly sensitive to changes in the flow stream. Pulp densities, quantity of head feed, shape or size of particles, richness of heads, and other variables, can fluctuate over rather wide ranges without affecting recovery or grade. In some cases prior removal of colloidal slimes improves concentration. Once adjusted, the spirals need little attention if plant fluctuations are within usual experience.

More Tons Per Man-Hour With Shuttle Car Haulage

SHUTTLE-CAR HAULAGE in the Carey Salt Co. mine near Hutchinson, Kan., has resulted in an increase of about 19 percent in tons of rock salt mined per man-hour, and has considerably simplified the salt-transport method. It is the purpose of this article to describe the shuttle-car method now in use and the system of scraper loading into mine cars, which it replaced.

Down about 400 ft. in the flat-lying sedimentary beds, surrounding Hutchinson, the first salt bed is encountered, and for 320 ft. further on down seams of rock salt alternate with seams of shale. Nowhere in all this 320-ft. thickness of salt and shale is there a seam thick enough to mine, except just one, which is 645 ft. down and is 12 ft. thick. The Carey Co. has been mining this seam since 1923 at a rate ranging up to 1,000 tons per day. The vastness of the entire deposit is suggested by the fact that the company could go on mining from this one seam for about 100 years at the present rate. The salt mined is used for making brine, curing hides, icing cars, and chemical purposes,

The shaft through which the salt is hoisted is 680 ft. deep, with the skip-loading station at 645 ft. The shaft is 18 ft. outside diameter and 14 ft. inside diameter, and is circular for the first 126 ft. of its depth. A water ring and pump sump are placed at this point to catch surface water and the seepage from a higher sandstone bed. From there to the bottom, the shaft is 11 ft. 6 in. square. It is timbered, with concrete poured behind the timbers to prevent decay of the limestone walls. A curtain wall in the shaft provides for mine air circulation, down behind the curtain and up in the skipway.

The firm of Allen & Garcia did the engineering work on the shaft and the surface plant, and the shaft was sunk by the Foundation Co. of Chicago. Work began on July 6, 1922, and was completed on June 23, 1923.

Salt is hoisted in 4-ton skips, and the maximum hoisting rate is 1,000 tons in 8 hr. Run-of-mine salt is put through a jaw crusher set to a 1½-in. discharge, then screened and re-crushed in a hammermill to minus ½-in., then re-screened. Six different sizes of salt are produced, varying from ½ in. on down. Blocks of 50 lb. are also pressed from the finest sizes for use in livestock feeding.

MODERN in design and equipment, the Carey Salt Co., Hutchinson, Kan., is using shuttle cars to offset in part the manpower shortage.

Table I. Shuttle Car Operating Data, Carey Salt Co.

Number of cars used,	two.
Tonnage handled,	600 tons per shift.
Weight of salt,	120 lb. per cu. ft.
Type of car,	Joy, 42D9, 8-ton, central conveyor, no gooseneck, battery-operated, using two 48-cell groups Exide batteries.
Charging equipment,	Charging stations on side entries; cars charged on off shifts. Exide controls; G.E. charger used.
Roadway length varies from 100 ft. to 750 ft. one way.	Fine salt as rock bed, rather bumpy; no maintenance on roadway.
Loading,	one Joy loader for two cars.
Unloading,	Joy elevating conveyor at control station from shuttle car to mine car.
Equipment replaced,	Scraper loader discharging directly into mine cars run on track built up into rooms.
Previous performance,	37 tons mined per man-hour.
Present performance,	44 tons mined per man-hour.

Mining Methods

Fig. 2 shows the layout of a typical section of the mine, including the main haulageway, the side entries, and the method of cutting rooms and pillars off the entries. Dimensions are given on the drawing. In the main haulageway 45-lb. rail is used, and 30-lb. rail in the side entries. An 8-ton G.E. combination trolley-battery locomotive is used for main haulage, and it pulls a string of 14 4-ton cars.

Rooms are advanced along the full 50-ft. face, leaving 50x40-ft. pillars in the checkerboard pattern shown. A new face is undercut with a

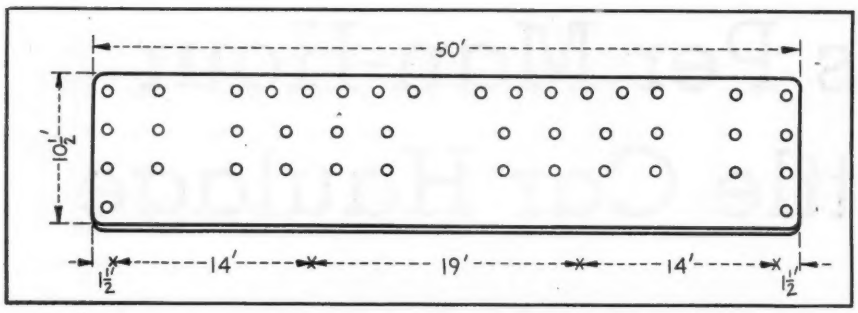


Fig. 1 . . . Pattern for drilling 50-ft. face in room in Carey mine; X indicates where drill is set up.

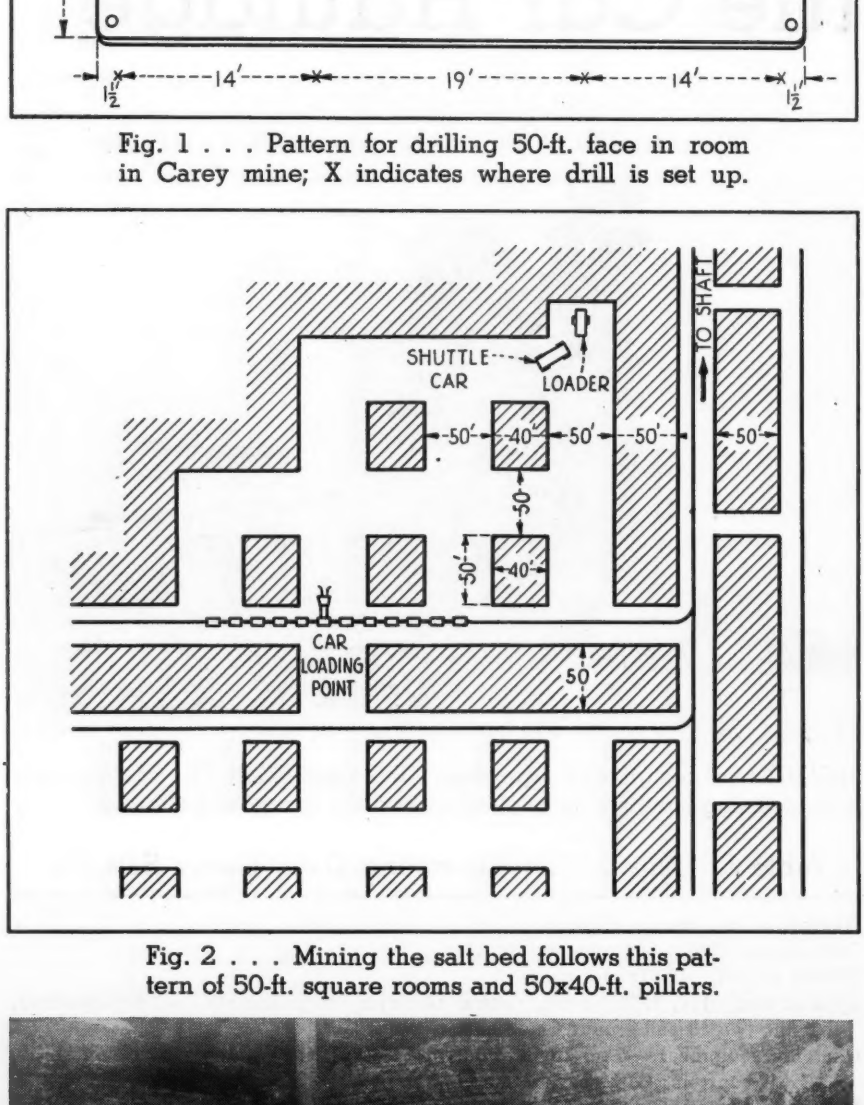


Fig. 2 . . . Mining the salt bed follows this pattern of 50-ft. square rooms and 50x40-ft. pillars.

DRILLING BLAST HOLES at one end of the 50-ft. face in a Carey mine room goes on simultaneously with an undercutting operation at the other end. Advance per round in this 10½-ft. bed of pure salt is 7 ft.

Goodman coal-cutting machine and drilled simultaneously with a Howells Mfg. Co. electric auger-type drill. Pattern for setting the 42 holes is shown in Fig. 1, and four drill set-ups are sufficient for the whole face. The advance for each round is 7 ft.

The holes are loaded with a Trojan dynamite made especially for this use, and about 240 sticks, or 200 lb., suffice for each round. About 225 tons of salt is broken per round, and it takes about 6 hr. to drill and load a complete face. The 50-ft. width is standard, but the height of the roof varies between 10 and 10½ ft., depending on the thickness of the salt seam. The roof always breaks cleanly to a thin shale seam that marks the upper limit of the salt.

Former Loading Method

Before shuttle cars were used the practice was to set up in each room after a blast, a special type of scraper loader. Snatch blocks were hung at each side of the face in the usual manner and the scraper cables were run back to a 3-drum hoist, mounted on a special caterpillar, self-propelled, loading ramp.

Mine track was run right up into each room, so that salt hauled in by the scraper and up the loader's ramp could be scraped directly into the mine cars. Capacity of this arrangement was about 37 tons per man-hour. Although it worked quite successfully, the drawbacks of the arrangement were the necessity of moving track clear up into the rooms, the time lost in rigging the scraper cables, and the difficulty in spotting empty cars for the loader.

Shuttle Cars

Table I gives most of the pertinent data on the Carey Co.'s two shuttle cars, which began operating in April, 1943. The original tires were still running in February, 1945, and are good for more service.

The two 8-ton cars serve one 11-BU Joy loader, which can load about 5 tons of salt per minute. The cars carry their loads to a central train loading station, so situated that the shuttle car haul is never more than 750 ft. one way.

Set up at this central station is a Joy elevating conveyor equipped with a hopper large enough so that hopper and conveyor together can hold one shuttle car load. Any excessively large lumps of salt are broken in the hopper with a K-14 Sullivan Buster. The conveyor dis-

Table II. Distribution of Mine Crew, Carey Salt Co.

Position	*Number*
Undercutter men	2
Drillers	2
Powderman	1
Shuttle car drivers	2
Loader operator	1
Elevating conveyor operator	1
Haulageway motorman	1
Skip tender	1
Foreman	1
	12

charges into a string of cars run in on track from the main haulageway.

Both elevator and car-spotting equipment are controlled by one man at a central station on the far side of the track from the elevators. The elevator is electrically controlled, but the cars are spotted by means of cables run out to each end of the 14-car train from an I-R double-drum hoist at the station. Control of the hoist is by foot pedals. Car spotting thus results in less spillage than when the locomotive is used.

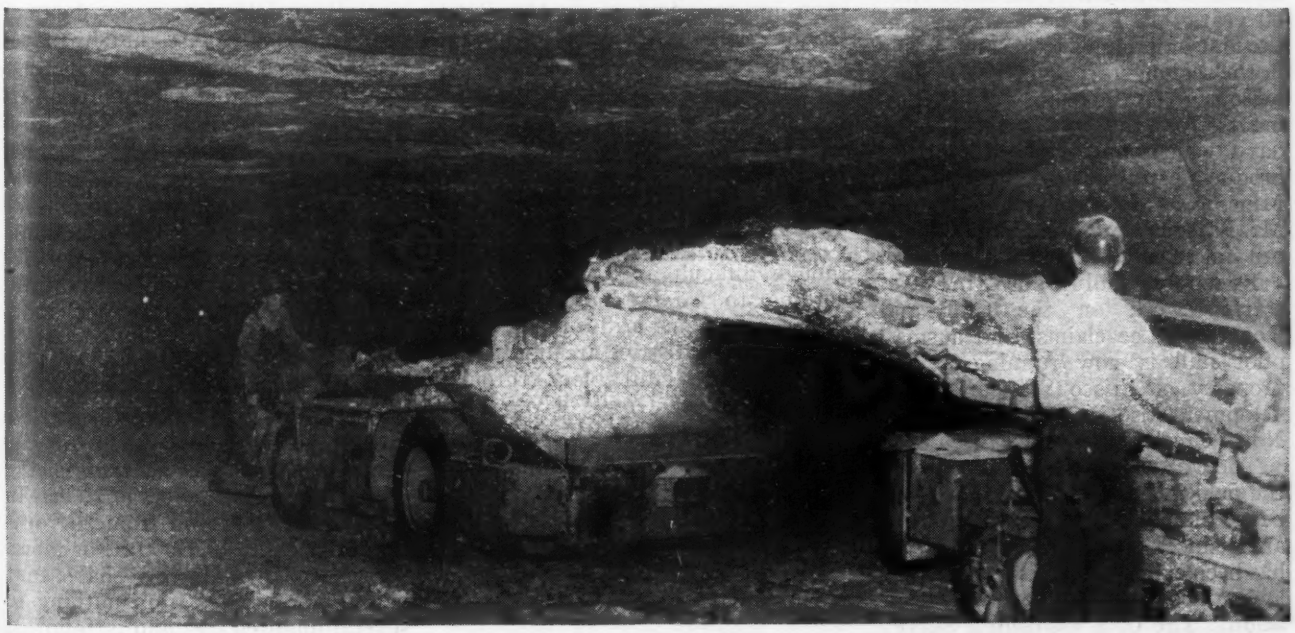
The only difficulty experienced with the shuttle cars thus far is with breakage of axles, a circumstance caused by the uneven roadway over which the cars have to travel. There is not manpower available at present to permit the establishment of a road crew.

Road for the cars is made up of fine salt that the Joy loader doesn't pick up. The road's roughness is caused by the 2 or 3-in. drop every 7 ft. that marks the end of one bite for the undercutter and the start of a new one.

As it is at most mines, manpower shortage is one of the chief difficulties faced by the Carey Co. Distribution of the 12-man mine crew is given in Table II. Production with this skeleton force is about 500 tons per day, but with a full crew 600 tons daily could be mined. Considerable ingenuity on the part of the management is necessary to make the best use of the men available, but sometimes more than ingenuity is required. For example, one day recently the mine crew was so suddenly and irremediably reduced that the manager was called upon to run the main haulage locomotive, the superintendent ran a shuttle car and the elevator, and the Joy loader man helped with undercutting and drilling. Production that day averaged 90 tons an hour.

S. B. Horrell is general manager of production of Carey Salt Co. at Hutchinson, and W. W. Tracy is mine superintendent. We acknowledge gratefully the information which they supplied.

DISCHARGING the car at the loading station. The operator beyond the line of cars controls the Joy elevating conveyor in the center and also spots the 4-ton mine cars through a double-drum hoist arrangement. An 8-ton shuttle car can be unloaded in a matter of seconds.



SHUTTLE CAR gets its cargo from a Joy loader working on the salt "muck pile." Note the clean break along the thin shale seam that forms the back in this mine. Only in a few places has a round broken through.

Metaline Falls Area Grows as Zinc Producer

JOHN B. HUTTL, *Associate Editor*

IN THE extreme northeastern corner of the State of Washington, with the town of Metaline Falls as its hub, an area that promises to become a zinc producer in the not-too-distant future has been under development for several years. Two major lead-zinc properties have been established so far. Much exploration has been done, and several new projects are being investigated or are in actual operation. The district can be reached by car over a good highway and by rail over a branch line of the Chicago, Milwaukee, St. Paul & Pacific R.R. Its proximity to Spokane, 110 miles south, assures a steady supply of materials at reasonable prices.

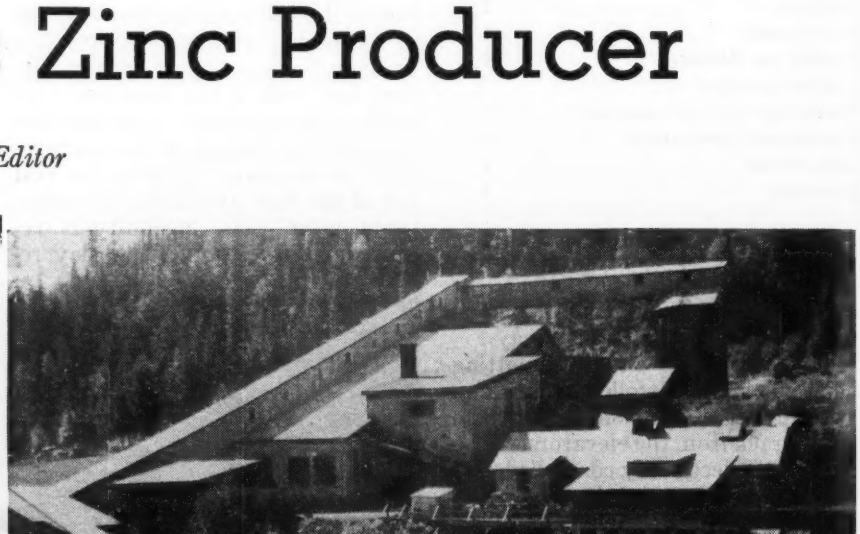
In general, the topography is mountainous and the climate differs little from that in other mining districts of the Pacific Northwest. The summer is pleasant; sub-zero temperatures and heavy snows prevail during the winter. Timber is plentiful, and the Pend Oreille River and numerous tributaries are a source of hydroelectric power.

Lead-zinc deposits have been known in the district for more than 60 years. L. P. Larson was one of the first individuals to become active in the region, starting in 1907. In a table is given the history of developments from then up to the present day, which finds two companies producing steadily—the Pend Oreille Mines & Metals Co. (of which Mr. Larson is president) and American Zinc, Lead & Smelting Company.

Recently, Columbia Zinc Co. started work on the Cliff and Robert E. Lee claims, and a small pilot mill is now running at the property of Frisco Standard. Development also is under way on the Noisy Creek claims.

The U. S. Bureau of Mines entered the field in December 1942, and has been diamond drilling unexplored areas since. A large tonnage of ore has been exposed by this work, which keeps two drills in constant operation. The U. S. Geological Survey has seven geologists at work.

A problem yet to be solved is that of power supply. Though there has been improvement since the Pend Oreille company installed its hydroelectric plant (*E.&M.J.*, Vol. 139, March 1938) and the DPC built an 850-hp. diesel plant at American Zinc's Grandview property, power shortage continues. Washington Water Power Co. is soon to construct a power line to the district.



THE 850-TON FLOTATION PLANT of Pend Oreille Mines & Metals Co., near Metaline Falls, Washington. Here the galena and sphalerite are separated from the quartz-dolomite gangue and from each other. The crushing plant is seen in the lower right.

The local geology is interesting, though difficult and complex. According to C. F. Park, Jr.,[1] the replacement zinc-lead orebodies of the Metaline district are limited to the disturbed fault block through which the Pend Oreille River flows and are associated with the major faults but are not in them. They are mostly near the top of the Metaline limestone, of Middle Cambrian age, and below black Ordovician slate. The ores are generally in jasperoid and surrounded by a shell of crystalline dolomite. Outside this dolomite is a shell of coarse-grained calcite that in places was deposited along solution channels long distances from known orebodies. Jasperoid, crystalline dolomite, and, to a less extent, coarse-grained calcite are therefore favorable but not infallible signs of the presence of ore near by. The Metaline limestone was dolomitized regionally before the ore was introduced, and this early dolomitization is independent of the ore.

In the area immediately north of Metaline Falls, in which lie the Pend Oreille property and the Grandview mine, the favorable beds in the Metaline limestone containing the minable orebodies average 200 ft. in thickness and extend from the outcrop to a depth of 1,000 ft. or more. They are overlain by shale that varies in thickness from nothing to several hundred feet and is followed by a sand and gravel overburden 10 to 525 ft. thick. The favorable beds

[1] Park, C. F., Jr., "Dolomite and Jasperoid in the Metaline District, Northeastern Washington." *Econ. Geol.*, Vol. 33, Nov. 1938, p. 709.

are siliceous and are badly faulted and fractured. The ore occurs in large, irregular bodies. Known beds dip from zero to 20 deg., their thickness varying from a few feet to 100 ft. In faulted areas a rapid change in thickness may take place within a few feet horizontally.

Large blocks of calcite from a few inches to 200 ft. wide and generally completely surrounded by ore, and low-grade sections of similar size assaying less than 2 percent zinc, are found in the ore zone. Wherever possible these are used for pillars and wall supports. The fractured ground in the ore zone is recemented or healed and stands up well, making possible the opening up of stopes 300 ft. long, 100 ft. wide, and 120 ft. high. Metal values are distributed irregularly, and a rapid drop or rise in the grade may take place within a few feet. Ore currently mined contains 5 to 7 percent zinc and 0.5 to 4 percent lead. Conditions underground at American Zinc's Metaline property differ from those in the area described in that the orebodies are smaller, faulting is more severe, and the ore higher in grade, averaging about 10 percent combined lead and zinc.

Surface prospecting is done with diamond drills. Total footage drilled since 1928 exceeds 500,000. In surface exploration holes have been put down 2,000 ft. The main purpose of these holes is to direct development and mining. Any discovery is explored later by a short drift or raise from the nearest stope. In testing walls and low-grade areas, holes are drilled 20 to 150 ft. in any direction and at any angle.

As the ground stands well in the ore zone, no timber is required (except for chutes) in development and stope work. Development drifts are 6x8 ft. in cross-section. The short raises from the drifts to the top of the ore measure 10x5 ft. The last-named openings often contain two compartments, for men and for ore respectively. Mining is done by open stope and pillar. The general procedure is to drive a raise at about 55 deg. from the drift in the ore zone to the hanging wall. This is followed by side-swiping with a drifter around the raise, closely following the ore. As the face advances, the back is scaled up to solid ground. Should the ore continue upward, a short raise or small shrinkage stope is started to remove metal-bearing material before advancing the main face again.

Benches 5 to 12 ft. high are then started from the raise after all walls on the level are barren. The blast holes drilled in two or three rows along the bench are 8 to 12 ft. deep. Broken ore is scraped into the raise, followed by preparation of a new face for drilling. Bench operations are continued until all ore has been removed from the stope. In sections where the ore extends down into the footwall and the position is such that it cannot economically be tapped at the bottom by a drift or raise, it is stoped by underhand methods, as shown in the sketch, p. 92. Here, too, bench operations are employed, with the difference that the tugger hoist is mounted on a wooden car-loading slide and the benches are started from it. The method has proved satisfactory up to a depth of 40 ft.

Broken ore is scraped to loading or storage points by hoe-type steel scrapers and tugger hoists. Ore is transported from loading chutes to shaft pocket and mill bins in 3- and 2-ton mine cars hauled by trolley or battery locomotives. One-ton end-dump cars are used in hand-tramming. Where natural ventilation gives poor results, additional air is furnished by Coppus blowers. Accumulated water is pumped to the surface or drain levels by centrifugal pumps. All drilling is done with modern air drills using steel with detachable bits. Mechanical shovels are used in drift work.

The properties of the two principal producers—Pend Oreille and American Zinc—are within 4 miles of Metaline Falls, and are accessible over good roads.

The Pend Oreille company's mine has been developed by two adits and two shafts. The former are the 7x8 ft. opening on the so-called Zero level and the 8x8-ft. 500-level tunnel. The shafts comprise the Josephine, sunk at 80 deg. and 5x10 ft. in cross-section, and the main shaft, which was completed in 1935 and serves the 700 level and 800 main haulage level. It is 320 ft. deep and has two compartments. Its collar is about 1,200 ft. from the mill.

Underground, about 95 percent of the ore in a given area is mined in stoping and 3 percent in subsequent cleaning up. The rest is left in pillars, to be recovered eventually. Ore dilution amounts to 15 percent, which is low in view of the irregular mineralization.

The ore sent to the 850-ton concentrator generally has to be ground to 48 mesh or finer to free the galena and the sphalerite from each other

38 Years of History

1907—L. P. Larson (now president of Pend Oreille Mines & Metals Co.) began development work.

1914—Mill using tables built.

1918—Ten years of inactivity, due to drop in metal prices, begins.

1927—Mill replaced by 100-ton flotation plant by interests represented by Larson. Grandview Mines builds 50-ton flotation pilot plant. Both properties shut down due to exhaustion of ore.

1928—Company now known as Pend Oreille Mines & Metals Co. starts diamond drilling.

1929—Pend Oreille finds commercial ore. Grandview resumes, increases mill capacity by 175 tons.

1930—Grandview shuts down again. Pend Oreille remodels mill and starts.

1932—Pend Oreille shuts down again on account of low metal prices.

1933—American Zinc, Lead & Smelting Co. enters district, diamond drills Bella Mae claims of Metaline Mining & Leasing Co. at Metaline.

1933—To date. Pend Oreille builds 250-ton mill, sinks two-compartment shaft to explore newly drilled orebodies, enlarges mill to 700 tons, installs 2,250-kva. hydroelectric plant. Operates continuously from 1936 to date.

1937—To date. American Zinc remodels Grandview mill to handle Metaline ore, drills Grandview property. Produces steadily from 1940 to date.

and from the quartz-dolomite gangue. Save for the fact that the de-leading unit has been shut down and a 6-cell flotation machine has been added to remove zinc from the regrind product before returning it to the head of the zinc rougher circuit to increase zinc recovery, mill operations are substantially the same as described by Lambly and Milliken in *E.&M.J.*, March, 1940.

Crushing is done in two stages, the second in closed circuit with a ½-in. screen. Equipment includes a 15 x36-in. Traylor jaw crusher, 4x8 ft. A-C ⅞x2½-in. vibrating screen, and a 4-ft. Symons cone. The finished product is stored for grinding in two 600-ton circular bins. One of these bins feeds a 7x6-ft. A-C ball mill having a 7x16-ft. Hardinge classifier, and the other an 8-ft. by 48-in. Hardinge mill followed by a 60-in. Akins classifier. Grinding is done to 48 to 55 percent minus-200 mesh, depending on the dissemination of the zinc.

Flotation of lead is effected in two 10-cell Union Iron Works machines using only Aerofloat 31 as a collector. This is added to the ball mills. No reagents are needed to depress the zinc. Tailings from these machines are conditioned with copper sulphate and floated in two 12-cell Denver Sub-A machines and three Southwestern cleaners. In general, pine oil and ethyl xanthate are used in the zinc circuit, but, when the feed is high in pyrite, sodium Aerofloat is used in place of the ethyl xanthate. The lead rougher concentrates are cleaned twice and the zinc rougher concentrates are cleaned three times.

Primary zinc cleaner tailings are sent to an 8-ft. cone classifier. The underflow is ground in a 4x4-ft. regrind mill, the overflow going to the 6-cell machine mentioned before returning to the head of the zinc circuit. Finished lead and zinc concentrates are filtered in a 2-disk and 4-disk American filter, respectively, and trucked to the railroad at Metaline Falls for shipment to the smelter.

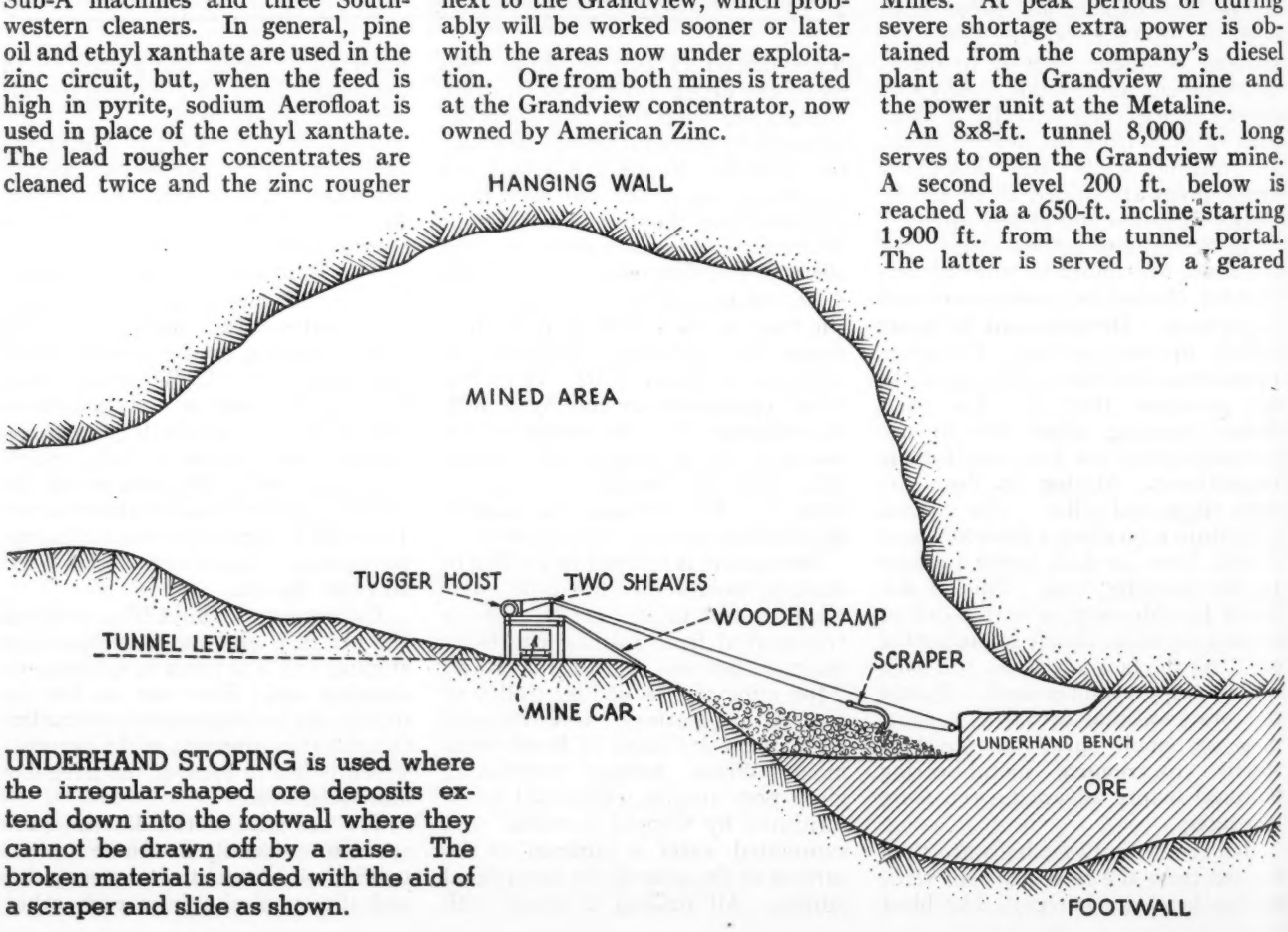
Lewis P. Larson is president of the Pend Oreille company, Jens Jensen is secretary-treasurer, C. A. R. Lambly, general superintendent, E. H. Miller, mine superintendent, C. F. Hoff, mill superintendent, J. C. Crampton, assayer, and E. A. Frick, engineer.

American Zinc's two properties are the Metaline mine, 2 miles south of Metaline Falls, and the Grandview mine, 2½ miles north. The former is owned by Metaline Mining & Leasing Co., a Washington corporation in which American Zinc has a 51 percent interest. The Grandview mine, as now developed, is on the property of Grandview Mines, Inc., also incorporated in Washington, and is leased by American Zinc on a royalty basis. The company also owns or controls other properties next to the Grandview, which probably will be worked sooner or later with the areas now under exploitation. Ore from both mines is treated at the Grandview concentrator, now owned by American Zinc.

The Metaline mine is opened by an 8x8-ft. tunnel, now about 6,100 ft. long. Development work and mining are both under way below and above this level. The lower level, 245 ft. below the tunnel, is reached by a 410-ft. incline and a vertical shaft 4,000 ft. and 5,000 ft., respectively, from the portal. Workings above the tunnel are reached through inclined raises containing a manway and an ore pass. A raise from the upper level to an old stope in the adjacent Bella Mae mine served by a tunnel running to the surface provides natural ventilation for most of the mine. Remote workings are ventilated by portable blowers.

Aside from modifications required by the nature of the ground, mining is done as at the other mines. Orebodies in the favorable zone are smaller and faulting is more severe, though the ore broken is higher in grade than that in the area north of Metaline Falls. Compressed air is furnished by a plant at the portal containing a 1,500-c.f.m. compressor driven by a 300-hp. motor, and a 600-c.f.m. standby unit powered by a 6-cylinder Cummins diesel engine. Here also are the mine office, change room, shop, and warehouse. Power is purchased from the Lehigh Portland Cement Co. and Pend Oreille Mines. At peak periods or during severe shortage extra power is obtained from the company's diesel plant at the Grandview mine and the power unit at the Metaline.

An 8x8-ft. tunnel 8,000 ft. long serves to open the Grandview mine. A second level 200 ft. below is reached via a 650-ft. incline starting 1,900 ft. from the tunnel portal. The latter is served by a geared



UNDERHAND STOPING is used where the irregular-shaped ore deposits extend down into the footwall where they cannot be drawn off by a raise. The broken material is loaded with the aid of a scraper and slide as shown.

hoist (80-h.p. motor) operating a 6-ton skip. Broken ore is brought to the loading pocket in 2-ton cars drawn by a 5-ton trolley locomotive. From this the ore is hauled in 6-ton cars by 10-ton trolley locomotives through the tunnel to the crushing plant.

Mining is done by open-stope methods as at the other mines, with hoe-type scrapers operated by 15-h.p. hoists scraping it to ore pockets and loading chutes. In this mine are some of the largest openings in the district. Workings in the main tunnel area are ventilated naturally through surface openings, blowers being used for the dead ends. The plant at portal comprises a change room, shops, and a powder preparation room.

Current milling at the 600-ton concentrator, which is near the Grandview tunnel portal, is of more than ordinary interest. Ore from the Metaline mine, brought in 5-ton trucks, and that from the Grandview, which is delivered in 6-ton cars, is stored in separate bins at the crushing plant. This unit can handle 60 tons per hour, and the concentrator 25 to 30 tons of crushed material per hour, depending on the hardness. Minus-18-in. mine-run ore is reduced in size to 1½ to 2 in. in a Gates 8K gyratory having extra thick concaves. Crushed material next goes to a set of 54x20-in. rolls, operating in closed circuit with a 4x10-ft. Low-Head vibrating screen, adjusted to give a ½-in. product. The circulating load is about 100 percent. The screen undersize is sampled and weighed automatically before going to the 400-ton fine-ore bin, this being necessary because ores from two mines owned by different companies are milled. The ores are crushed, sampled, and weighed separately, but are combined in the storage bin before grinding.

Problems involved in concentrating the ores received are:

1. The gangue is cherty dolomitic limestone, very tough, hard, and abrasive.

2. The lead mineral generally is massive and not entangled with the zinc mineral in its crystallization, and permits maximum recovery with the coarsest grinding possible for satisfactory handling through the flotation machines.

3. A considerable part of the zinc mineral is fine-grained and often a pseudomorph of the rock crystal which it replaces.

4. Part of the zinc mineral crystallization is blocky, requiring relatively coarse grinding to free, and a considerable portion is finely disseminated, calling for extremely fine grinding to free it from the gangue. No attempt is made initially to grind the zinc flotation feed to a fineness that would free most of the zinc mineral from the gangue, as this would be expensive owing to the extreme hardness of the ore. The alternative practice, which is followed, is to float selectively the coarse zinc and other free zinc at the start, as a concentrate developed in the 42-mesh fraction from the primary grinding, and then float the middlings and put them through a grinding circuit until the mineral is freed to the extent that a satisfactory grade of concentrate and tailing result. The milling procedure here will be described in detail in a subsequent article.

Howard I. Young is president of American Zinc. D. I. Hayes, the Western manager, directs operations at both properties in the Metaline Falls area. H. F. Mills is general superintendent, D. P. Knowles, mine superintendent, Homer P. March, mill superintendent, Orin Weeks, mine engineer, and D. A. Underwood, metallurgist.

Searles Lake Major Lithium Source

IN THE LAST SIX YEARS the quantity of lithium salts produced in the United States has been increased substantially by the entry of the American Potash & Chemical Corp., of Trona, Calif., into the ranks of primary lithium salt producers. Prior to 1939 all lithium compounds were derived from various complex lithium ores. The new production comes from Searles Lake, on the Mojave Desert, in San Bernardino County, Calif., the brines of which have long yielded borax, potash, soda ash, sodium sulphate, bromine, and other chemicals. Only recently have they been exploited for their lithium value.

Searles Lake is in reality a desert salt-pan or playa. Following rains, which are infrequent, it may be covered with a few inches of water, but usually the salt surface is dry and will easily support the weight of heavy vehicles. For the most part, the "lake" consists of a solid body of crystalline salts extending to a depth of 60 to 90 ft. The exposed surface of the main salt body covers an area of approximately twelve square miles, while the extent of the total known deposit is about thirty square miles, containing possibly 100,000,000 tons of alkali salts per square mile.

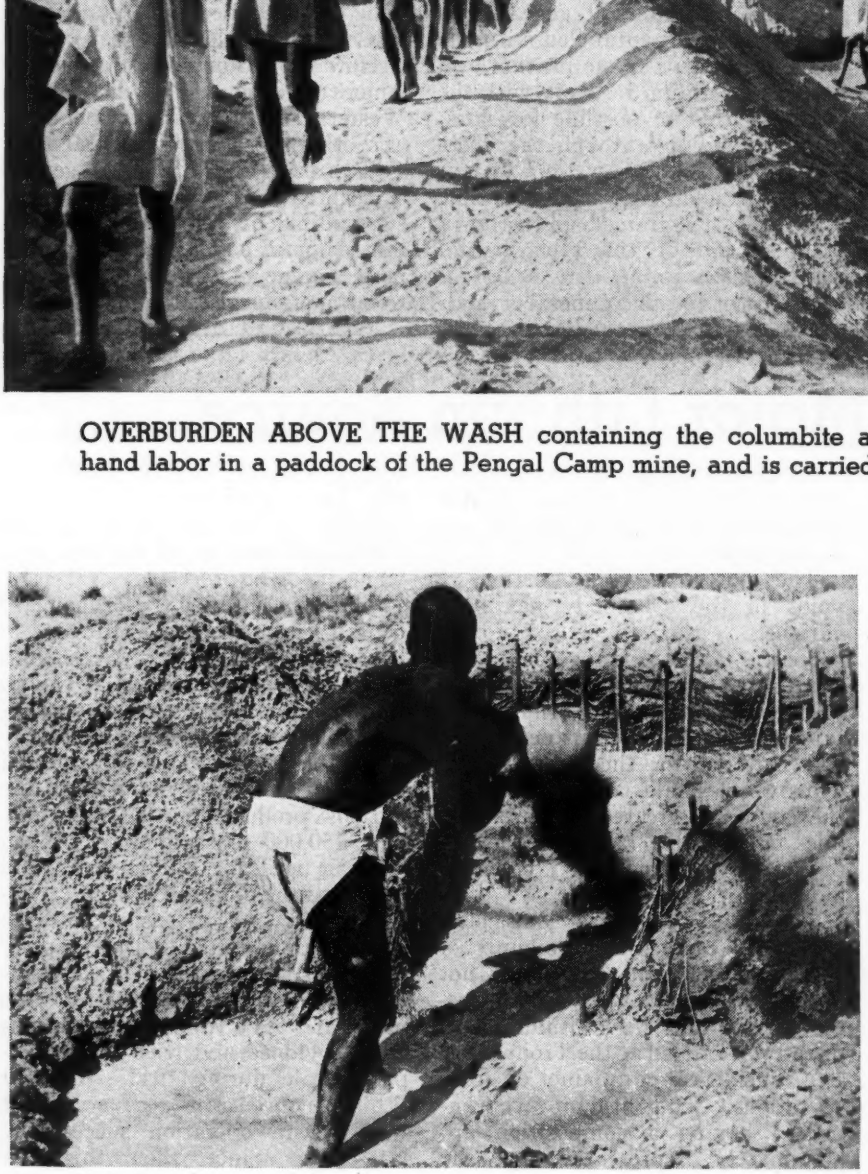
The porosity or proportion of voids in the salt body has been variously estimated at 25 to 45 percent. These voids are filled with a saturated brine. Wells drilled into the deposit extract this brine at the rate of about 17,500 tons per day as raw material for the Trona plant. Thus, Searles Lake constitutes one of the country's greatest single stockpiles of available raw materials for present-day American chemical industry.

The lake brine has long been known to carry small amounts of lithium in solution, but it was not until 1938 that a very limited recovery of a new crude lithium compound was started at the Trona plant as an incidental co-product of other operations. This lithium "concentrate," having a composition approximately represented by the formula Li_2NaPO_4, has found a ready market due to its extremely high lithium content (19 to 21 percent Li_2O) in comparison with the best lithium ore concentrates available for further refining. It is unexcelled for making other lithium compounds because of the ease with which it can be processed.

The brine entering the Trona plant contains approximately two tons of Li_2O per day, equivalent to ten tons of the compound Li_2NaPO_4. Not all of this is available for recovery, considerable quantities being inevitably lost in plant operations and through occlusion as a trace impurity in the various products, which aggregate over 450,000 tons annually. When wartime needs for lithium were found to exceed the domestic output capacity greatly, an extensive research project was initiated by the company early in 1942, aimed at a substantially increased recovery of this material. As a result a new process was developed and tried on a pilot-plant scale during 1943. A novel lithium concentrate recovery plant was put in operation successfully last year. Since then this has quadrupled the original production and has a potential capacity much greater than the prewar world requirements. See picture, p. 116.

Nigeria Supplies Columbite and Tin for War

OVERBURDEN ABOVE THE WASH containing the columbite and tantalite is stripped by hand labor in a paddock of the Pengal Camp mine, and is carried away from the mining area.



A TRIBUTER working on his own time on a lease on a "flat," or dried-up river bed. At the end of the week he will sell his washed concentrate to the manager of the mine on whose ground he has been employed.

PRODUCTION OF COLUMBITE IN NIGERIA is as a byproduct of tin mining, and the tin ore is obtained by so-called "alluvial" mining. The ground mined is partly alluvium and partly detritus. According to B. E. Frayling, formerly Chief Inspector of Mines in Northern Nigeria, this ground has been derived from two distinct mineralizations, associated with an older and younger granite respectively. The town of Jos, in the heart of Nigeria, is the commercial center of the industry.

The mines working in ground derived from the younger granite produce most of the cassiterite exported from Nigeria. In some of them, columbite is also present with the cassiterite. Both of these minerals survive through the detrital stage into well-sorted and much-concentrated alluvial placers.

Once it has been decided that the values justify working a property, a "paddock" is opened up, perhaps acres in extent. The overburden

above the "wash" which contains the values is first removed. There may also be holes in the bedrock which contain values. Mining may be done by company work or by tributing.

In very few paddocks of the "younger granite" mines is the weight of columbite in a cubic yard greater than the weight of cassiterite. Through all price fluctuations of both minerals, cassiterite has been more valuable than columbite, so that even the mines which are the chief producers of columbite are essentially tin mines. Any exception to this point of view would be as a result of International Tin Control being restrictive at a particular period in respect of a mine rich in columbite. There are no restrictions on the shipment of columbite, but cassiterite may have to be withheld from export until permission is given.

Limit As to Tantalum

Columbite from the younger granite areas has to meet the specification that it shall not have more than 8 percent tantalic oxide. Mines in the neighborhood of Kuru, near Jos, produce columbite which is almost a pure columbic oxide. The mineralization associated with the older granite was usually in pegmatite. In some areas the intrusions of pegmatite have a strong well-defined strike and dip. In others they are of irregular shape. The mines in the pegmatite areas are working detritus or alluvium which is not, generally, well sorted. In the pegmatite mineralization, the columbite ranged from almost pure columbic oxide to almost pure tantalic oxide, and from 5.4 to 7.9 specific gravity.

Before the present war, when the purchaser of columbite required a product containing not more than 8 percent tantalic oxide and the purchaser of tantalite wanted a product containing not less than 66 percent of tantalic oxide, the mineral from the pegmatitic areas lay mostly between the extremes desired. With the lowering of the tantalite specification to 30 percent tantalic oxide, the pegmatite areas are being re-examined for tantalite.

Although columbite is only a by-product and the mining operation is that of alluvial tin mining, the alluvial tin field developed on the usual lines. The early managements, if able to get water under sufficient head, could mine by the hydraulic method or, with less head, by sluice. With water scarce it might be saved and recirculated with power pumps. With no water for wet methods, the excavation would be by dry methods, either employing cheap labor using picks and shovels or mechanical excavators. The early excavators were mostly steam shovels. Today, most excavators are electric draglines.

Detritus may be mineralized from grass to bedrock, but in sorted placers there is usually a valueless overburden and the mineral in the wash below. The mineral-bearing ground is washed down in sluice boxes and the concentrates go to ore-dressing plants. Here, after simple wet methods to remove sand and most of the ilmenite, there is separation into magnetic and non-magnetic products. The cassiterite is in the non-magnetic product, except in rare cases when there is "magnetic tin," or cassiterite with sufficient of a magnetic mineral in intimate association to lift under the magnet.

The columbite is in the magnetic product with almost certainly some ilmenite and possibly wolfram, garnet, and monazite. Further differential separations are made until the columbite is as free from the mixture with other minerals as possible and within the requirements of the purchaser's specifications. All Nigerian columbite is sold to purchasers in the United States.

The accompanying pictures (credited to British Combine) of the operations involving the use of cheap native labor were made at the Pengal Camp mine of the Minerals Research Syndicate, in Bauchi Province, Nigeria. The property is an old one.

FROM EACH HEADPAN of concentrate (the result of a week's work by a tributer) a cigarette tin full of the mineral is weighed to determine the quality of the concentrate.

ON PAY DAY, each Saturday at Pengal Camp mine, the company's men, dressed in their best clothes, line up before the manager to receive what the record shows is due to each.

How Leadville Tunnel Is Driven Through Bad Ground

ROBERT A. ELGIN, *Supervising Engineer, Leadville Drainage Tunnel, Leadville, Colo.*

UNUSUAL GROUND-FIXATION methods have been developed in driving the first ½ mile of the Bureau of Mines' Leadville drainage tunnel for which Stiers Bros. Construction Co. is contractor and John R. Austin is contractor's superintendent. The tunnel bore has penetrated approximately ½ mile of excessively faulted, water-saturated, sedimentary formations in the northern part of the district.

Driven southeasterly from a point on the East Fork of the Arkansas River at an altitude of 9,957 ft., the tunnel is expected to drain, and give access to, an estimated 3,000,000 tons of lead-zinc ores and 1,000,000 tons of manganese ore. Drainage will affect the Fryer Hill, Downtown, Carbonate Hill, and Iron Hill areas, from which the major part of the past production of the district has been obtained. The Leadville mines are credited with the greatest mineral production in the State, with a valuation exceeding $400,000,000.

WATER FLOWING from tunnel face at about 2,000-ft. point developed into potential mud rush soon after this picture was taken. Tunnel was then bulkheaded and bypass built.

Heavy Timber Needed

The Leadville drainage tunnel is a 9x9-ft. bore with a 24-in. gage track along the center line. Ditches along both sides of the track have a total capacity of 10,000 g.p.m. The haulage track is built of 52-lb. rails mounted on 6x8-in. ties. The standard timber sets are made of 10x10-in. Oregon pine and consist of side posts and a three-piece framed arch.

The interval between the tunnel sets has varied according to the character of the ground penetrated. In some instances the sets are as close together as 2½ ft., but usually they are on 5-ft. centers. In firm ground that nevertheless requires timber support, sets are placed on 6-ft. centers. For the first 700 ft. the tunnel was driven through unconsolidated surface detritus consisting of glacial drift boulders, clay, sand, and gravel. In this area 4x6-in. timber spiles were required around the full tunnel set, except at the bottom. In addition, breast boards were necessary in the course of driving the first 400 ft. of the tunnel.

Bedrock was struck at 350 ft., but the upward slope of its surface was so gradual that the tunnel was not entirely under the bedrock surface until it had been driven approximately 700 ft. A heavy flow of water was found to be concentrated along the bedrock surface, making it difficult to control the loosely consolidated sand and gravel. By driving a small advance heading along the contact, it was possible to control the water and support the loose material when excavating for the full-size tunnel heading. There was no need for the top heading beyond Station 700, so it was discontinued.

First Mud Rush

The tunnel was driven through soft shale and sandstone from stations 700 to 2,100 without undue difficulty, but timber sets were required for the entire distance. At Station 2,100 an intrusive porphyry dike was encountered, which, although dry, was highly altered. The dike rock appeared firm when mined, but it was noted that boulders of the material disintegrated rapidly when placed in water. At Station 2,126, the porphyry showed further alteration and indicated a higher degree of disintegration. A small trickle of water at the face suddenly developed into a run of mud, water, and sand. Approximately 1,500 cu.yd. of this material ran into the tunnel within a few hours. Simultaneously the flow of water from the tunnel increased

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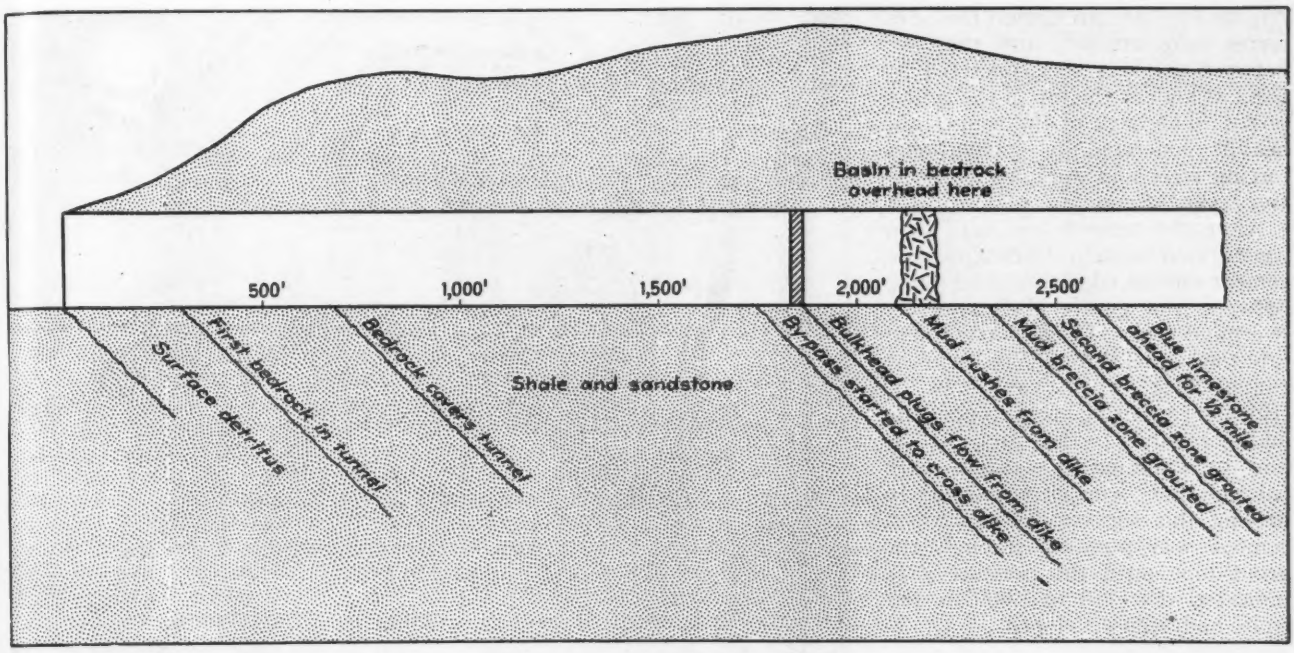


TUNNEL SECTION showing points at which difficulties described in text were encountered. Tunnel was driven to dike at 2,126 ft. before mud rushes made bulkhead at 1,800 ft. necessary.

from 250 g.p.m. to approximately 500 g.p.m.

The tunnel was cleaned up without difficulty, but an attempt to advance the heading resulted in a cave-in at the face and another run of material. At this time, the electric locomotive, mechanical loader, and four 91-cu.ft. muck cars, fully loaded, were at the face. The mud rushed into the tunnel so rapidly that the crew kept ahead of it only with difficulty. The motorman kept the locomotive ahead of the surge of mud, sand, and gravel, but the four loaded cars and the mechanical loader were caught in the flow and rolled and tumbled 400 ft. back from the face. There they jammed between the tunnel sets and effectively dammed the flow.

Third Rush Develops

The tunnel was again cleaned up for approximately 100 ft. when a small flow of water from the back of the tunnel at that point rapidly developed into a surge of several thousand gallons a minute. This water was thick with sand and gravel, and it was apparent that another heavy run would soon develop unless it were brought under control. A wooden bulkhead was therefore constructed to stop the flow of sand and gravel at its point of entrance. The bulkhead performed its function effectively, but choking off the flow of sand and gravel also choked off a large part of the water, thus creating a threat of additional break-throughs.

Test holes drilled into the tunnel back in the area in which the runs occurred showed that a large depression in the bedrock surface overhead reduced the bedrock covering of the tunnel to only a few feet. It became apparent that standard methods of tunnel driving had been inadequate in this part of the tunnel and that a different procedure must be adopted.

Study of the situation indicated that it was extremely unlikely that the last 400 ft. of the tunnel could be reopened and a large basin of mud, water, sand, and gravel successfully controlled without resorting to pressure methods such as are used in driving tunnels beneath rivers. Holes along the tunnel line, drilled from the surface, had shown that the water-table elevation was approximately 180 ft above the tunnel level, which indicated that a pressure of approximately 80 lb. per sq.in. would be required to overcome the water pressure head. Because this pressure is greater than that under which men can work, it was decided to drive the tunnel around the caved area.

Bypass Planned

Although the center line of the bypass was only 45 ft. west of the original tunnel line, it offered the advantage of being driven through material that had not been disturbed and the further advantage that the conditions to be encountered were known. To insure against recurrence of an unexpected inrush of water from the caved section of the tunnel, a concrete bulkhead was placed immediately back of the wooden bulkhead, and three short 8-in. pipes were cemented through the concrete. Next, long 6-in. pipes were extended through the 8-in. pipes, through the wooden bulkhead, and into the water, sand, and gravel beyond. The pipes were then cleared with a blowpipe to permit maximum drainage of the water. In this way drainage was obtained without danger of a run of material. As a further precaution, the section of the tunnel on the near side was heavily gunited to prevent further break-throughs.

Gunite Defined

The term "gunite" as used in this article, means concrete formed by pneumatically applying with a gunite machine successive layers of mortar, composed of cement, sand, hot water, and calcium chloride. In all guniting and grouting undertaken in the tunnel, hot water was used in the mixture and calcium chloride in the ratio of 1 lb. for each 100 lb. of cement. With an underground water temperature of 37 deg. F., straight cement mixtures made with cold water did not set for several days. This difficulty was overcome by using calcium chloride and hot water.

Only one further incident occurred in starting the bypass. At the point at which the bypass diverged from the main tunnel, the timber sets suddenly took weight and would have given way had they not been quickly

reinforced. To strengthen this area forms were erected, and the area between the sets was concreted by hand as high as the top of the tunnel posts. The back of the tunnel was heavily concreted by placing reinforcing steel and applying consecutive layers of gunite.

After the cement had set, holes were drilled through the concrete and cement was forced with a grout pump between the gunite shell and the overlying rock. Leakage of cement into the tunnel through cracks in the tunnel back, which could not be sealed by guniting, was stopped by adding sawdust to the grout mixture and by caulking the cracks with oakum and wooden wedges. In driving this section of the tunnel, cement was pumped through the grout pipe until the pressure gage indicated that 750 to 1,000 lb. per sq.in. had been developed.

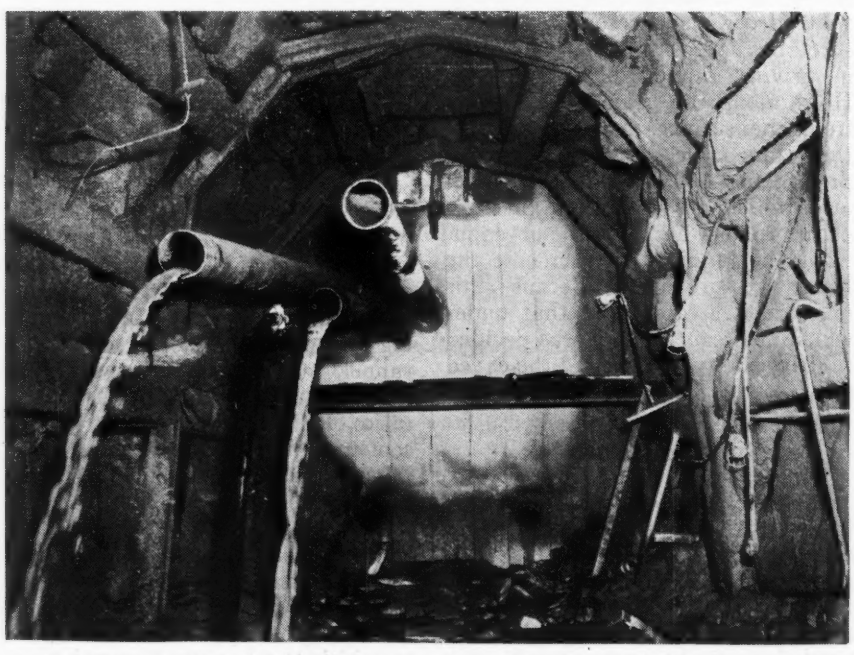
Bypass Crosses Dike

After the section of the tunnel at the switch had been concreted, the bypass was continued without further incident until it reached the porphyry dike that had caused so much trouble in the original heading. Test holes 30 to 40 ft. deep, drilled at diverging angles in the tunnel face, were precautions against encountering unexpected pockets of mud and water. The test holes showed that the bedrock covering throughout this area was 4 to 12 ft. thick. Whenever possible, the material was excavated with mechanical spaders, and holes were drilled and blasted only in sections in which the rock was so hard that it could not be spaded. Constant close supervision and inspection were necessary to guard against another break-through of the sand, mud, and water known to lie along the bedrock surface directly above the tunnel.

WATER PRESSURE was 90 lb. on this pipe placed in heavy ground near bypass to permit grouting to seal tunnel walls. Men are placing valve. Pumpcrete for grout in right foreground.

The porphyry dike was encountered in the tunnel bypass at a point almost directly opposite that at which the mud flows occurred in the original tunnel. The dike material met in the bypass showed even more weathering and oxidation than were previously in evidence and the rock on both sides of the dike was badly crushed and faulted. Although the dike itself was dry, the faulted formations on both sides were extremely wet.

All of this section of the tunnel was concreted by hand to the bottom of the tunnel caps, and the tunnel back was thoroughly concreted by the application of gunite. Usually the tunnel was concreted in 20- to 30-ft. sections, which were found to fit into the cycle of operations most conveniently. In addition, the long test holes driven in advance of the tunnel face, which encountered a heavy flow of water containing mud or sand, were used to cement the surrounding area with the pressure grout pump. Numerous weep holes were drilled after concreting; and weep pipes were also placed preceding concreting wherever a heavy flow of water was



CONCRETE BULKHEAD, 3 ft. thick, sealed tunnel after two mud rushes and threat of third forced abandonment of 400 ft. of tunnel beyond 1,726-ft. mark. Three 6-in. pipes drain bedrock basin close overhead.

entering the tunnel. In this way, all possible water was allowed to drain into the tunnel so that high water pressures would not develop.

Breccia Starts New Flow

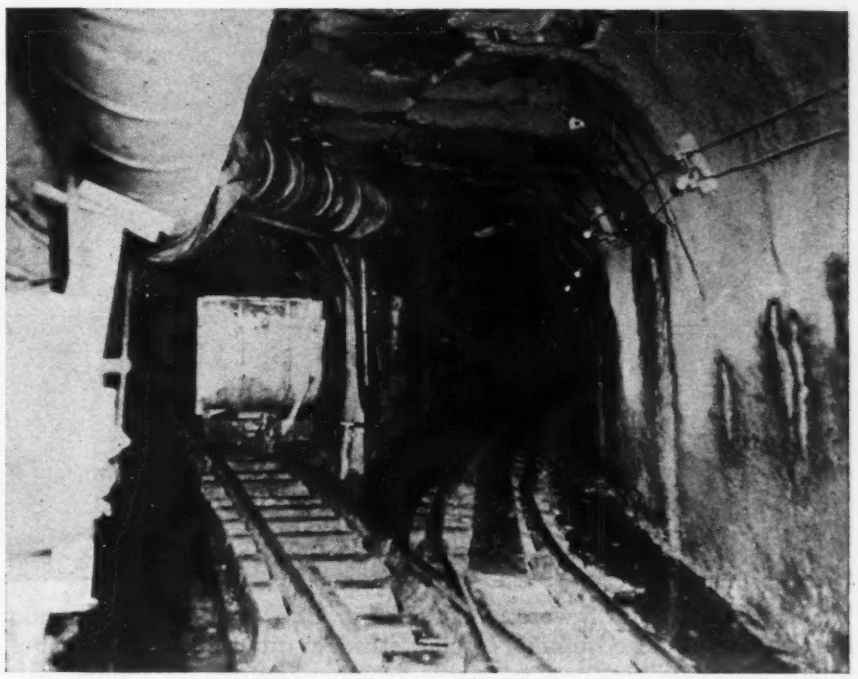
At Station 2,200, the tunnel passed from porphyry into Leadville ("blue") limestone, the formation in which most of the rich orebodies of the Leadville district have occurred. A fault of large displacement was crossed at Station 2,250; and the tunnel passed into dolomites and quartzites, which were identified as being part of the sedimentary series of a much lower geologic horizon than the Leadville limestone. A heavy flow of water entered the tunnel, along the fault contact, but the walls on each side of the fault were hard and gave no difficulty.

Then a wide shattered zone, in which the rock had been partly decomposed to form a mud breccia, was encountered by the test holes beyond Station 2,300. The tunnel was advanced cautiously, but at Station 2,328, in spite of the use of spiling and breast boards, a rush of mud and water broke into the tunnel at the face. Preparations had been made for such an eventuality, and the opening was immediately choked off with timber. When the mud and water broke through, it was estimated that the flow reached 3,000 or 4,000 g.p.m. When the flow was choked off, the volume of water was reduced to 1,150 g.p.m.

Because the area penetrated at this point was badly shattered, it was necessary to concrete before proceeding further. After concreting, an attempt was made to reopen the tunnel face. However, as soon as a small opening, no larger than 2 ft. in diameter, had been made, a rush of water estimated to be approximately 3,000 g.p.m. spurted into the tunnel, accompanied by mud, sand, and rock fragments.

New Method Required

It became apparent that it would be impossible to drive the tunnel through this area without some unusual procedure. It was decided to attempt to seal off the zone by forming a solidified core of the mud breccia and driving the tunnel through this segment. Formations containing a high percentage of mud and water are usually solidified by freezing the material. Cementing is usually unsuccessful because of the difficulty of obtaining uniform distribution within the area to be controlled. In this instance, however, it was decided to attempt drilling rows of radiating holes, extending well beyond the periphery of the tunnel, and forcing cement through these holes with the grout pump, grouting each hole and each row of holes in succession.



COMPLETED BYPASS at right, old tunnel at left. Note heavy guniting. Bypass paralleled old section 45 ft. to west.

The principal problem at this time was to prevent leakage of the cement back into the tunnel. The tunnel face was shattered so badly that it was impossible to force the grout under pressure through the formation; therefore, a heavy concrete bulkhead, containing several 4-in. pipes, was placed across the tunnel face. The pipes were then connected with a Pumpcrete machine, and 11 cu.yd. of concrete was forced into the shattered area beyond the bulkhead to fill the existing voids.

Oats Hold Cement

When the cement was forced into grout holes drilled through the bulkhead, it was found to be escaping back into the tunnel through numerous cracks in the bottom, back, and sides. The area was so badly shattered, and such a large volume of water entered the tunnel, that it was extremely difficult to concrete the section tightly enough to prevent the escape of the grout mixture. However, this problem was overcome by drilling a series of short holes through the concrete, beginning 40 ft. back of the face, and forcing a mixture of cement, calcium chloride, hot water, and oats into the area immediately back of the concrete. Because of their ability to expand upon absorbing water, the oats effectively sealed the numerous small fractures through which cement and water were escaping.

Next, a series of longer holes was drilled extending beyond the periphery of the tunnel, and cement was forced through these holes consecutively until pressures of approximately 300 lb. per sq.in. were indicated. Next, 40-ft. holes were drilled extending well ahead and to the outside of the tunnel periphery. These holes in turn were consecutively cemented with the grout pump.

After a lapse of 24 hours to let the cement set, 40-ft. test holes were drilled ahead of the tunnel face to determine if the mud, water, sand, and rock fragments had been consolidated. Next, a number of weep holes were drilled well outside the tunnel boundary to drain as much water as possible from the outlying fractured zone. To have as close control as possible over the shattered zone when penetrated, it was decided to pass through the area with a small 4- by 6-ft. top heading before advancing the full-size tunnel. The upper part of the concrete bulkhead was therefore blasted out, and the top heading was driven across the fault zone without difficulty.

Grouting Is Successful

Next, the full-size heading was also advanced to the solid ground beyond.

WORST CONDITIONS were met at Station 2328, where flow from mud breccia again choked tunnel, forcing crews to grout and solidify entire zone. Bulkhead was built to enable grouting beyond; then upper part was blasted out and small heading shown here was driven through fault zone, followed by main tunnel.

Only one pocket of material not thoroughly cemented was encountered, and this was estimated to contain approximately 10 cu.yd. of mud. When the mud ran out of the pocket, the surrounding area was shown to be thoroughly consolidated by the cement used in grouting, and in the entire area from Station 2,328 to Station 2,356, cement could be observed in thousands of fractures varying in thickness from $\frac{1}{8}$ in. to as much as 8 in. In effecting the solidification of this section, 2,248 sacks of cement, or approximately 112 tons, were utilized.

A peculiar feature of the shattered zone penetrated was that, in spite of the quantity of mud encountered, the faulting, which was responsible for the condition, had displaced the sedimentary beds only a few feet. Many of the faults previously crossed were the result of a much greater ground movement but had caused no trouble in driving the tunnel.

Test holes showed another faulted, shattered zone at Station 2,440, which also contained a large volume of water and mud and showed every indication of running. In this instance, there was a sufficient pillar of solid rock between the tunnel face and the shattered zone to permit grouting without resorting to concreting of the face and sides of the tunnel. After carrying out the procedure used previously, it was found that a cement core had been formed through which the tunnel could be driven. In this instance, 1,448 sacks of cement were required to accomplish solidification of the altered formation.

Future Use for Method

The particular method adopted at the Leadville drainage tunnel to consolidate shattered areas containing large quantities of mud, water, and sand, through which it is necessary to drive mine workings, has never been used in the district before, so far as is known. Previously, when similar conditions were encountered, it was necessary to stop work until the section had drained, a procedure involving considerable lost time and many uncertain elements, at best. Several large faults are known to cross the tunnel right-of-way, and it is expected that conditions will be encountered similar to those that have been successfully overcome. The success of the procedure developed, however, leads to the belief that such areas can be quickly and safely crossed.

The tunnel has now entered the main body of the Leadville limestone, and holes ahead, drilled along the tunnel right-of-way, together with the geologic information available, indicate that the next $\frac{1}{2}$ mile of the tunnel will be through an area that has not been subjected to the same degree of intensive fracturing and faulting as the one through which the tunnel has already been driven. Much of the area ahead undoubtedly can be driven without timber support, and it is expected that a rapid rate of advance can be attained. Moreover, the tunnel will penetrate an extensive area of Leadville limestone that has not been previously prospected and may contain mineralized areas capable of ore production.

John R. Austin, director of the contractor's forces, and Louis Stiles, tunnel superintendent, have consistently given the Bureau of Mines staff the full benefit of their many years' experience in driving tunnels in most of the Western states.

France an Important Producer of Iron Ore Before War

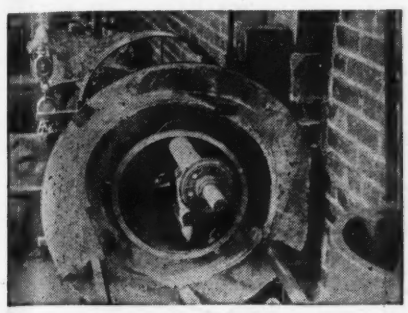
THE IMPORTANCE OF CONTINENTAL FRANCE as a producer of iron ore prior to the war may be judged from data supplied in a report "Iron Mines in France" recently prepared by L. Dupret, civil mining engineer with the Supply Mission for France, now in Washington, D.C. In the four years preceding the war the country's production ranged from 32,000,000 tons in 1935 to 37,800,000 tons in 1937, dropping to 33,100,000 in 1938. In the boom year, 1929, it reached 50,700,000 tons.

Output in 1938 came principally from five districts: Meurthe-et-Moselle, 17,256,000; Moselle, 13,773,000; Normandie, 1,589,000; Anjou Bretagne, 389,000; and Pyrenees, 109,000. Other districts yielded an additional 24,000 tons. The figures cited do not include North African production. In 1938 Algeria produced 3,034,000 tons, Tunisia, 28,821, and Morocco, 266,000. Of the total output for so-called metropolitan France, Meurthe-et-Moselle and Moselle produced 94 percent, and Normandie, $4\frac{1}{2}$ percent. The first two districts include the following Briey, Aumetz, Fentsch, Orne, Longwy (which lies in the two districts) Calvados and Nancy. The first two areas named produce the bulk of the output.

Contributing this production are some 40-odd companies. Of these, five contributed 1,000,000 to 1,500,000 tons in 1935, and three from 1,500,000 to almost 2,500,000 tons. The production of the others ranged from 241,000 to 829,000 in that year.

OPERATING IDEAS

Rings Are Evenly Heated by Rotating Device



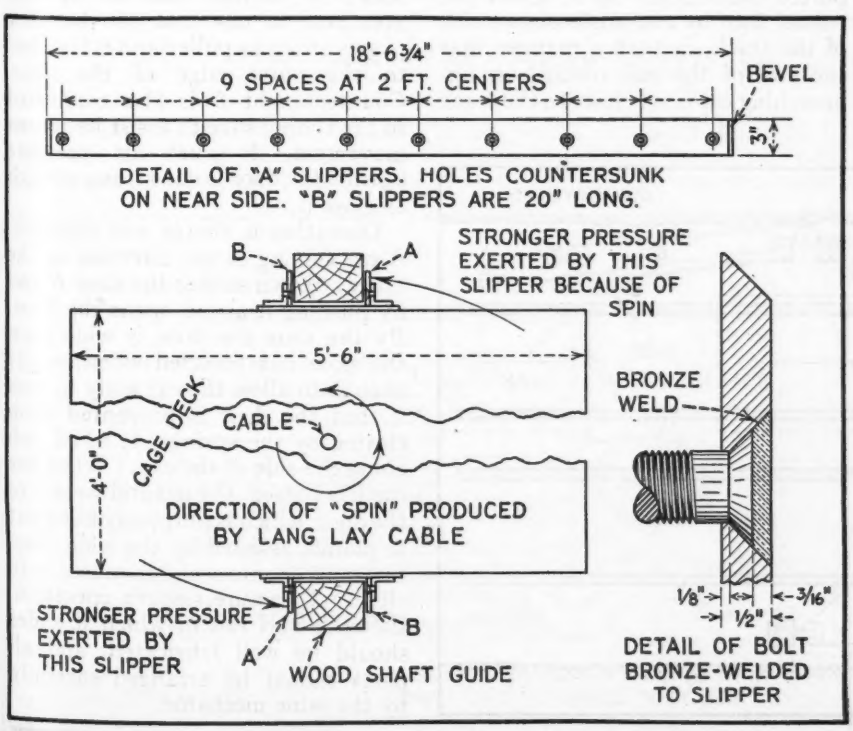
THE EQUIPMENT here illustrated enables shop workers to heat rings and bands evenly at all points. A large stationary disk of ¼-in. plate is bolted to a vertical frame of light angles and covered with sheet asbestos. Rings are suspended on a shaft which projects through the upper part of the disk. The drive pulley shown behind the disk rotates the shaft, which in turn causes the suspended rings to rotate. A gas or oil burner projects through the center of the disk and directs a flame against the objects to be heated. If many rings are to be heated at the same time, an asbestos-lined cylindrical housing is placed on top of the three rods projecting from the lower part of the disk in such a way as to confine the generated heat to the area around the heater and disks.

New Slipper Design Reduces Shaft Guide Wear

AFTER STUDYING THE CAUSES OF WEAR on wooden guides and slippers on skip and cage assemblies in the shaft of Sigma Mines, Ltd., Quebec, M. Priske, master mechanic, reports that improved mild steel slippers were installed to reduce wear appreciably. Formerly abrasive resistant steel slippers 30 in. long were used on skip and cage assemblies. Later, mild steel slippers tipped with Colmonoy No. 6 were tried. In each case guide wear was excessive. Finally mild steel alone was tried. The slippers lasted 5 to 6 weeks in each of these trials. Shaft guides of British Columbia fir had to be replaced after 12 to 15 months of service. Turning the guides about, doubled their life.

It was then noted that the "spin" produced by the 1⅜-in. Lang lay cables used in the shaft causes the slippers marked *A* in the accompanying drawing to exert stronger pressures against the guides than those marked *B*. This pressure is distributed over a greater area by increasing the length of the *A* slippers from 30 in. to 18 ft. 6¾ in., the full length of the bail from which the cage and skips are suspended. The slippers are attached to the bail by countersunk bolts which are first bronze-welded to the slippers as shown in the accompanying drawing. The bronzed surfaces are then ground smooth to eliminate all irregular surfaces which might catch abrasive particles and score the guides. The *B* slippers are attached in the same way, but are only 30 in. long.

Once every two weeks the face and sides of guides are greased with No. 66 Alemite. After a period of 18 months, guide wear has been practically negligible, and the life of slippers has been increased fourfold to an average of six months. This performance was noted when the mine was hoisting 1,000 tons of ore and 50 tons of waste daily from a depth of about 2,000 ft. One compartment of the shaft was equipped with a 6-ton skip and the other with a 5-ton skip and cage assembly.



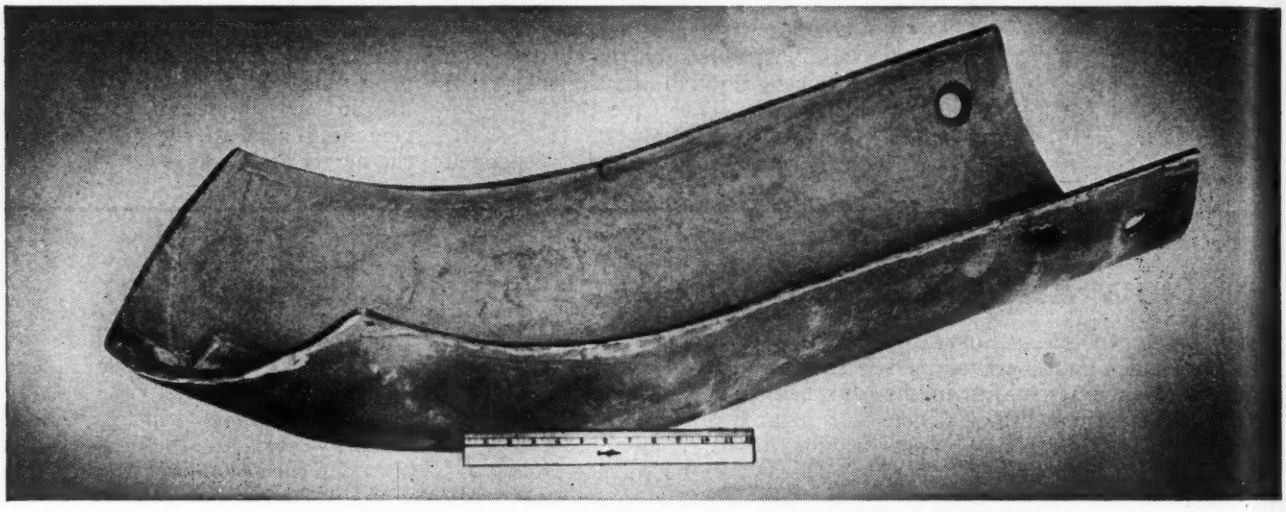
Don't underestimate the value of your ideas. *After solving a difficult operating problem, don't assume that no further benefit can be derived from your efforts. Tell others about your success. E.&M.J. pays $5 or more for each idea published.*

Alloy Iron Liner Outwears Steel

FLOWING ABRASIVE PARTICLES create operating difficulties, particularly where they are deflected. Normally steel abrasion plates or liners will resist wear satisfactorily, but if conditions are severe, cast alloy liners such as the one illustrated may improve performance.

The Electro Metallurgical Co. reports that in one plant a bent spout feeding hard, abrasive ore into a dryer was a "sore spot." Elbow liners of steel castings wore out in two to four weeks. The substitution of alloy iron castings containing 25 percent chromium increased the life of the liners from six to eight months—a life span of eight to eleven times that of steel liners. The number of shutdowns required to make repairs and replacements was decreased in like proportion.

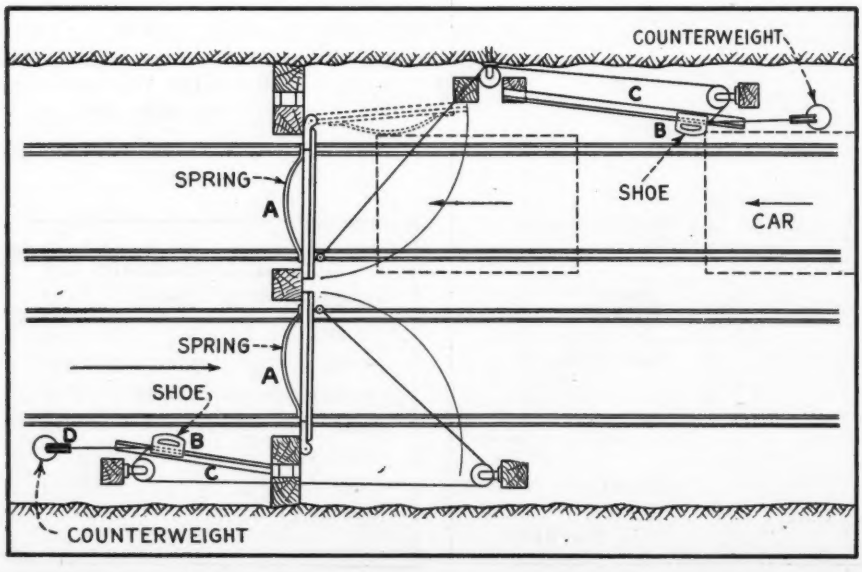
In many other applications involving extreme wear, high-chromium irons have been used to similar advantage—such as liners for dredge pumps, pugmill knives, and crushing machinery. Such parts have good strength and resistance to shock and vibration as well.



Foot rule indicates size of abrasion-resistant feed spout liner cast of 25 percent chromium alloy iron. The liner weighs 65 pounds.

Moving Mine Car Opens Door Automatically

AN INSTALLATION USED at a gold-silver mine in Central Mexico by which a door across an airway can be opened automatically by an approaching locomotive or mine car is explained in detail in the accompanying illustration. The rail *C* is supported horizontally 2½ ft. above the tunnel floor by two stulls on one side of the track, in such a manner that the end of the rail toward an approaching car is set closer to the track than the other end. On this rail slides the slotted shoe *B*. A rope attached to one end of the shoe passes around a pulley and is fastened to the outer edge of the door. Counterweight *D* is also connected to the sliding shoe to assist its return movement if usual air pressure against the door is not strong enough to close it.



Operation is simple and effective. A car coming in the direction of the arrows shown strikes the shoe *B* and by pushing it ahead opens the door. By the time the door is wide open the shoe has traveled sideways far enough to allow the car body to pass it, but the door is prevented from closing by the springs *A*, which rub along the side of the car. When the car has passed, the natural weight of the door, which is purposely hung out of plumb, assisted by the wind pressure and counterweight, causes it to close. To assure smooth operation, the shoe and rail in which it slides should be well lubricated, and all parts should be arranged carefully by the mine mechanic.

Diamond Drill Bits Reconditioned With Acid

AQUA REGIA was used to recondition diamond drill bits after wear had reduced the cutting clearance of the stones set in the matrix, according to L. R. Vance, mining engineer, Hecla Mining Co., Wallace, Idaho. The bits which were treated by this method were Sinta-Set.

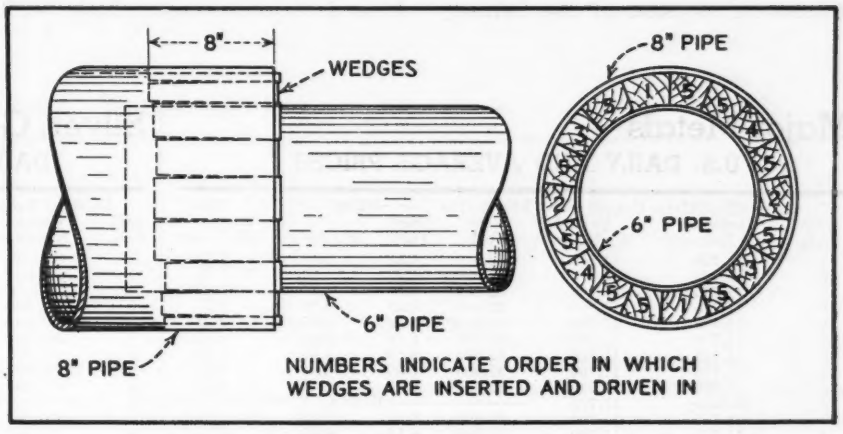
Normally, bits containing a matrix impregnated with stones are reconditioned by subjecting worn cutting faces to sand-blasting. In the absence of sand-blasting equipment, bits were immersed in a shallow watch glass partly filled with aqua regia so that only the cutting face came in contact with the acid. As a second precaution to prevent acid from attacking the body of the bit or the bronze holding the cutting segment of the bit, the bit was immersed, threads down, in melted paraffin until only the cutting surface was exposed. The length of time of treatment or the number of acid changes required for reconditioning varies with different bits. However, the process need only be continued until stones can be seen or felt above the matrix.

Water-Line Repair Made With Wedges

AFTER A HUGE BOULDER had wrecked a 6-in. water line feeding a mill in an isolated property, W. G. Rinehart, of Batesville, Ark., made the following repairs with limited materials and tools:

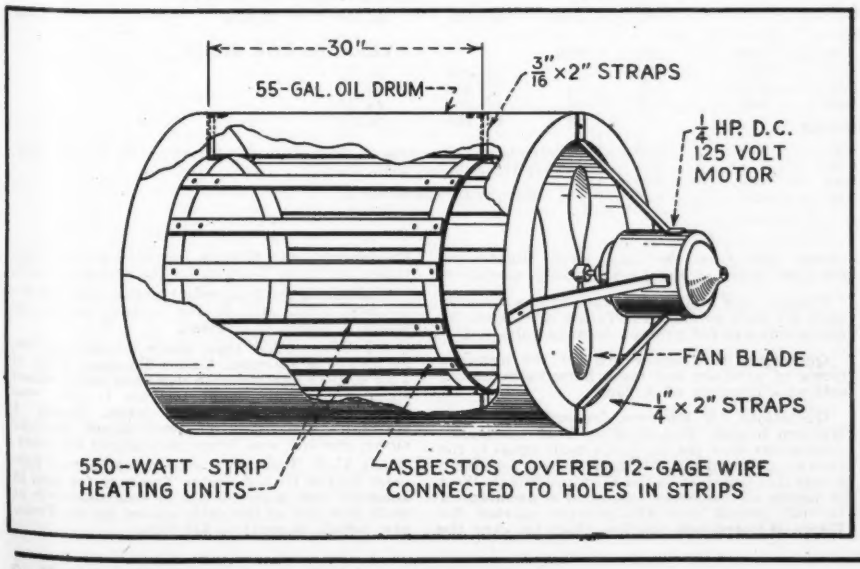
A 6-ft. section of smashed pipe was cut out with a hacksaw. Ends of the water line were moved away from the boulder. An available 10-ft. section of 8-in. pipe was then slipped over the two ends of the 6-in. line to form a long connecting sleeve. The spaces between the two pipes at either end of this sleeve were filled with oak wedges as shown in the accompanying illustration.

Wedges, approximately $\frac{7}{8}$ in. square and 8 in. long, were cut from pieces of 1-in. dressed oak lumber, and slightly tapered. Wedges marked 1, 2, 3, and 4 were inserted in the open spaces between the pipes and driven their full length in that order. Wedges marked 5 were placed in the remaining openings and driven in a little at a time until all of them were flush with the other wedges. The entire repair job was completed in two and one-half hours.



Portable Heater Built in Mine Shop

MINE MECHANICS constructed the portable heater here illustrated from a discarded 55-gal. oil can and other spare parts, according to Paul C. Ziemke, Oak Ridge, Tenn., who adds that the equipment was used effectively to dry out flooded electric motors and heat a first-aid room. A $\frac{1}{4}$-hp. motor fitted with a fan blade was mounted into an 18-in. opening in the drum by means of four $\frac{1}{4}$x2-in. straps as shown. The other end of the drum was cut out.


30"
55-GAL. OIL DRUM
3/16 x 2" STRAPS
1/4 HP. D.C. 125 VOLT MOTOR
FAN BLADE
1/4 x 2" STRAPS
550-WATT STRIP HEATING UNITS
ASBESTOS COVERED 12-GAGE WIRE CONNECTED TO HOLES IN STRIPS

Thirteen Cutler-Hammer 550-watt, 115-v. strip heaters were bolted to two $\frac{1}{4}$x2-in. strap-iron rings and mounted inside the drum by means of $\frac{3}{16}$x2-in. straps. Two additional bolt holes were drilled in the strips so that they could be connected to rotary switches, three of which were installed to control the current used in the heater. The dryer was then covered with $\frac{1}{4}$-in. asbestos sheeting, which in turn was covered with 26-gage sheet metal. Band-iron legs were mounted on the bottom of the heater. The fan supplies a current of air, which after being heated is directed into motor windings.

MARKET SUMMARY

FEBRUARY WAS A MONTH of high activity in the war metals. The movement of copper was hampered by manpower shortages and transportation difficulties, and the stockpile was reduced further. Copper has been stored in warehouses at points not exactly convenient for quick handling under trying conditions; consequently the deliveries over the first two months of the year fell short of expectations. Zinc deliveries, on the other hand, were of record proportions, as substantial tonnages were stored at the smelters instead of warehouses. The month was featured by a return to allocation for both zinc and antimony.

Copper Institute reported deliveries of copper for January of 145,904 tons, against 156,800 tons in December. The fabricating division of the industry placed consumption of copper in January at 149,538 tons, against 142,149 tons in the preceding month. In spite of shipping difficulties, consumption of copper in the first quarter of 1945 is expected to exceed that of the same period of 1944 by a wide margin. Imports were maintained at a high level throughout the Jan.-Feb. period, and are scheduled to increase this spring when African and Canadian metal will begin to move into the United States on a larger scale than heretofore. An official of the Foreign Economic Administration revealed that our procurement of foreign copper at present is at the rate of about 1,000,000 tons a year, the bulk of which is obtained on the basis of 11.75c., United States ports.

The problem of balancing supply and demand of lead occupied both WPB officials and members of the industry throughout the month. The lead order was revised, with further changes in prospect as the month ended. The stockpile was reduced to less than 70,000 tons. Increased supplies are expected from foreign sources, though quick action to relieve the tight supply situation is not considered likely. Stocks of refined lead in the hands of domestic refiners increased 8,202 tons to 27,738 tons during January, which was viewed as a favorable development growing out of the limitation order imposed by WPB. Production of refined lead in this country during January amounted to 49,099 tons, against 46,052 tons in December. Imports are averaging between 18,000 and 20,000 tons a month, and are expected to increase soon. Domestic consumption is being reduced to

Major Metals

U.S. DAILY AND AVERAGE PRICES

1945 Feb.	Electrolytic Copper: Domestic (a) Refinery	Electrolytic Copper: Export (b) Refinery	Straits Tin: New York	Lead: New York	Lead: St. Louis	Zinc: St. Louis
1	11.775	11.700	52.000	6.50	6.35	8.25
2	11.775	11.700	52.000	6.50	6.35	8.25
3	11.775	11.700	52.000	6.50	6.35	8.25
5	11.775	11.700	52.000	6.50	6.35	8.25
6	11.775	11.700	52.000	6.50	6.35	8.25
7	11.775	11.700	52.000	6.50	6.35	8.25
8	11.775	11.700	52.000	6.50	6.35	8.25
9	11.775	11.700	52.000	6.50	6.35	8.25
10	11.775	11.700	52.000	6.50	6.35	8.25
12	Holiday	11.700	Holiday			
13	11.775	11.700	52.000	6.50	6.35	8.25
14	11.775	11.700	52.000	6.50	6.35	8.25
15	11.775	11.700	52.000	6.50	6.35	8.25
16	11.775	11.700	52.000	6.50	6.35	8.25
17	11.775	11.700	52.000	6.50	6.35	8.25
19	11.775	11.700	52.000	6.50	6.35	8.25
20	11.775	11.700	52.000	6.50	6.35	8.25
21	11.775	11.700	52.000	6.50	6.35	8.25
22	Holiday	11.700	Holiday			
23	11.775	11.700	52.000	6.50	6.35	8.25
24	11.775	11.700	52.000	6.50	6.35	8.25
26	11.775	11.700	52.000	6.50	6.35	8.25
27	11.775	11.700	52.000	6.50	6.35	8.25
28	11.775	11.700	52.000	6.50	6.35	8.25
	AVERAGES FOR MONTH					
Feb.	11.775	11.700	52.000	6.50	6.35	8.25
	AVERAGES FOR WEEK					
Feb. 7	11.775	11.700	52.000	6.50	6.35	8.25
14	11.775	11.700	52.000	6.50	6.35	8.25
21	11.775	11.700	52.000	6.50	6.35	8.25
28	11.775	11.700	52.000	6.50	6.35	8.25
	CALENDAR WEEK AVERAGES					
3	11.775	11.700	52.000	6.50	6.35	8.25
10	11.775	11.700	52.000	6.50	6.35	8.25
17	11.775	11.700	52.000	6.50	6.35	8.25
24	11.775	11.700	52.000	6.50	6.35	8.25

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Owing to the World War and the disruption of normal trade relations, our export copper quotations, since September, 1939, have been based largely on f.a.s. transactions, ex United States ports. We deduct .05c. from the f.a.s. basis (lighterage, etc.) to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

1945 Feb.	Sterling Exchange: "Checks" (Nominal)	Silver: (c) New York	Silver: London	Gold: London	Gold: (d) United States
1	401.000	44.750	25.500	168s.	$35.000
2	401.000	44.750	25.500	168s.	35.000
3	401.000	(e)	(e)	(e)	35.000
5	401.000	44.750	25.500	168s.	35.000
6	401.000	44.750	25.500	168s.	35.000
7	401.000	44.750	25.500	168s.	35.000
8	401.000	44.750	25.500	168s.	35.000
9	401.000	44.750	25.500	168s.	35.000
10	401.000	(e)	(e)	(e)	35.000
12	Holiday		25.500	168s.	Holiday
13	401.000	44.750	25.500	168s.	35.000
14	401.000	44.750	25.500	168s.	35.000
15	401.000	44.750	25.500	168s.	35.000
16	401.000	44.750	25.500	168s.	35.000
17	401.000	(e)	(e)	(e)	35.000
19	401.000	44.750	25.500	168s.	35.000
20	401.000	44.750	25.500	168s.	35.000
21	401.000	44.750	25.500	168s.	35.000
22	Holiday		25.500	168s.	Holiday
23	401.000	44.750	25.500	168s.	35.000
24	401.000	(e)	(e)	(e)	35.000
26	401.000	44.750	25.500	168s.	35.000
27	402.000	44.750	25.500	168s.	35.000
28	402.000	44.750	25.500	168s.	35.000
	AVERAGES FOR MONTH				
Feb.	401.091	44.750	25.500	—	35.000
	AVERAGES FOR WEEK				
Feb. 7	401.000	44.750	—	—	
14	401.000	44.750	—	—	
21	401.000	44.750	—	—	
28	401.400	44.750	—	—	

Calendar week averages, New York Silver: Feb. 3rd, 44.750; 10th, 44.750; 17th, 44.750; 24th, 44.750.

(e) Not quoted (Saturday).

Engineering and Mining Journal's average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c. per troy ounce. Handy & Harman's quotations on newly-mined domestic silver, 999 fine, was 70⅝c. throughout February.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

approximately 70,000 tons a month.

Effective April 1, slab zinc again will be under full allocation control by the Tin-Lead-Zinc Division, WPB. On shipments to be made prior to April 30, 1945, applications should be filed with WPB before March 12, it was stated officially. Producers will not be required to indorse certificates. The shrinkage in stocks of Special High Grade and Prime Western forced WPB to restore allocation.

Antimony also went back under allocation, owing chiefly to heavy war demands for oxide for flame-proofing, etc.

Quicksilver received a jolt when Mercurio Europeo offered metal in quantity for March shipment from Spain on the basis of $155 to $160 per flask, duty paid, New York. This occurred at a time when the scarcity of supplies here caused some sellers to ask as high as $175. As February ended spot and nearby quicksilver was offered at $165 per flask. Authorities claim that imports will be needed to meet expanding demands for the metal.

Miscellaneous Metals Monthly Averages

Average prices of miscellaneous metals for January and February:

(a) New York, packed in cases, in lots of 5 tons or more but less than a carload. (b) Nominal. (c) Producer's price for commercial sticks. (d) Average producers' and platers' quotations, (e) Special shapes sold to platers.

	Jan.	Feb.
Quicksilver, N. Y. flask	156.846	165.545
Antimony (a)	15.839	15.839
Antimony, bulk, Laredo	14.500	14.500
Antimony, bulk, N. Y.	15.265	15.265
Antimony, Chinese (b)	16.500	16.500
Platinum, oz. troy	35.000	35.000
Cadmium (c)	90.000	90.000
Cadmium (d)	92.500	92.500
Cadmium (e)	95.000	95.000
Aluminum ingot	15.000	15.000

E & M J Price Index

Weighted index of non-ferrous metal prices (copper, lead, zinc, tin, silver, nickel, and aluminum). The average for the years 1922-1923-1924 equals 100.

1929	110.33	1937	90.86
1930	82.87	1938	73.67
1931	60.20	1939	77.71
1932	48.26	1940	79.22
1933	59.79	1941	83.49
1934	69.59	1942	86.80
1935	74.66	1943	88.74
1936	73.45	1944	88.74

	1943	1944	1945
January	88.74	88.74	88.74
February	88.74	88.74	88.74
March	88.74	88.74	....
April	88.74	88.74	....
May	88.74	88.74	....
June	88.74	88.74	....
July	88.74	88.74	....
August	88.74	88.74	....
September	88.74	88.74	....
October	88.74	88.74	....
November	88.74	88.74	....
December	88.74	88.74	....

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated
(March 1, 1945)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb.	15c.
Antimony, domestic, spot, lb., 5 tons or more	15.839c.
Bismuth, ton lots, lb.	$1.25
Cadmium, commercial sticks, lb.	90c.
Calcium, lb., ton lots, 97@ 98 percent, cast	$1.85
Chromium, 97 per cent grade, lb.	89c.
Cobalt, 97 to 99 per cent, per lb.	$1.50
Indium, troy oz.	$7.50
Nickel, electrolytic cathodes, lb.	35c.
Magnesium, 99.8 per cent, carloads, lb.	20½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation) troy oz.	$35.00
Quicksilver, flask of 76 lb., 100 flasks or more	$165.00
Selenium, 99.5 per cent, lb.	$1.75
Silicon, minimum 97 per cent, spot, carloads, lb.	14.75c.
Tellurium, lb.	$1.75
Thallium, 100 lb. or more, lb.	$12.50 nom.
Titanium, 96 to 98 per cent, lb.	$5.00

METALLIC ORES

Beryllium Ore, 8 to 12% BeO, f.o.b. mine, per unit	$14.50
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 48% Cr_2O_3, 2.8 to 1 ratio	$41.00
48% Cr_2O_3 3 to 1 ratio	$43.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$4.75
Mesabi bessemer	$4.60
Old Range non-bessemer	$4.60
Mesabi, non-bessemer	$4.45
Lead (Galena) 80 per cent, Joplin, Mo., ton	$76.01
Manganese, Metals Reserve Co. sales price, per long-ton unit of Mn contained, 48 per cent, subject to premiums and penalties, effective May 15, 1944: 85c. (duty paid) New York, Philadelphia, Baltimore, Norfolk, Mobile, and New Orleans; 91c., Fontana, Calif., Provo, Utah, and Pueblo, Colo.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 60 per cent, duty paid	$24.00
Domestic, 60 per cent and upward	$24.00@$24.50
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton	$55.28
(a) Prices at mines, small lots, normally several dollars less.	

METALLIC COMPOUNDS

Arsenic Oxide (arsenic) lb.	4c.
Cobalt Oxide, 70 @ 71 per cent, lb.	$1.84
Copper Sulphate, 100 lb.	$5.00

ALLOYS

Beryllium Copper, 2.5 to 3 per cent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 per cent per lb. of Cr contained	13c.
Ferromanganese, 78 @ 82 per cent, gross ton	$135.00
Ferromolybdenum, 55 @ 65 per cent Mo, lb. of Mo contained	95c.
Ferrosilicon, 50 per cent, per lb. of contained Si	6.60@8.10c.
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.90
Ferrovanadium, per lb. of V delivered	$2.70@$2.90
Silicomanganese, 1 per cent C, gross ton	$133.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canadian (Quebec) mines (U.S. funds), ton:	
Crude No. 1	$650@$758
Crude No. 2	$165@$385
Spinning fibers	$124@$233
Paper stock	$44@$49.50
Shorts	$14.50@$26.50
Vermont, f.o.b. Hyde Park:	
Shingle stock	$62.50@$65.00
Paper stock	$44.00@$53.00
Shorts	$14.50@$28.50
Floats	$19.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$8.50@$9.00
Missouri, 93 to 94 per cent $BaSO_4$, per short ton	$8.25@$8.50
Bauxite, long ton:	
Domestic, crude, 50 @ 52 per cent (not dried)	$5.00
Domestic, chemical, 55 @ 58 per cent	$7.50@$8.50
Domestic, abrasive, 80 @ 84 per cent	$16.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$15.00
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 60 per cent, all rail movement, ton	$30.00
Acid 98 and 1 per cent, bulk, ton	$37.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, f.o.b. Washington	$22.00
Mica — Colonial Mica Corp., agent for Metals Reserve Co., quotes full-trimmed ruby muscovite domestic, April 1 to June 30, inclusive — No. 1, $1.70 to $36.65 per lb., depending on size; No. 2, $1.25 to $26.00; No. 2 Inferior, 50c. to $16.00; No. 3, 25c. to $6.25. Prices f.o.b. nearest producer's rifting plant.	
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c i f. Atlantic ports	12c. nom.
Silica, in bags, 325 mesh, ton	$20.00@$40.00
Sulphur, Texas, mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
Vermont, extra white, 200 mesh	$9.50@$10.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton: Basic	$24.50
Steel, base price, Pittsburgh Billets, gross ton	$34.00
Structural shapes, 100 lb.	$2.10

WASHINGTON REFLECTIONS

McGRAW-HILL WASHINGTON NEWS BUREAU

Appropriations Expected For New Access Roads

Need for legislation to extend the Defense Highway Act of 1941 under which the access road program has been carried out and an appropriation of $12,000,000 to meet estimated needs for 1945 has been stressed by Senator Scrugham, of Nevada. An extension of the program has the official backing of the War Production Board, the Petroleum Administration for War, the Solid Fuels Administration, and other government agencies.

Basis for WPB support of the move is the need for access roads into areas where coal, oil, and lumber may be produced in time to be of use in this war. The metal and mineral program is generally considered nearing completion, with only isolated cases remaining. The $12,000,000 figure is the sum of the estimated needs of all the various agencies.

The maintenance of roads already built into mining operations, however, is an important argument for the extended program on the basis that it is the means of preserving scarce tires and trucks. Senator Scrugham's office points out that both construction and maintenance in almost all cases would be force account jobs carried out by the men and machines of the Forest Service or other government agency. This answers the question regarding the availability of labor and equipment, since it is claimed the road crews might otherwise be idle part of the time. Inquiry at the office of Congressman Robinson regarding the expected time the appropriation will be available brought no direct answer other than that work on it would be started promptly. This is interpreted to mean that the appropriation will be included in one of the first deficiency bills presented to the present Congress. Nothing is expected to hinder early passage of the legislation.

Allocations Resumed to Control Zinc Sales

The mid-February announcement that zinc was to be returned to allocation could hardly be classed as a surprise. When shipments exceeded production by 8,697 tons in December and 22,312 tons in January, there could be but one answer.

Early in February zinc producers were told that the new order would follow the old one closely and that it would probably require consumers to apply for authorization to accept deliveries of zinc.

The arithmetic of the supply situation has been officially stated as follows: "Indicated 1945 consumption is 1,078,000 tons of slab zinc as compared with an indicated production, including imports, of 870,000 tons, leaving a deficit of 208,000 tons." On this basis a shortage of 18,000 tons per month is forecast. Of the two principal uses, ammunition brass will take 480,000 tons in 1945 and galvanizing another 270,000 tons.

WPB has also reported that domestic production of zinc concentrates is dropping, with 1945 production estimated at 660,000 tons of recoverable zinc compared to 715,000 tons in 1944. Available imports of 340,000 tons during 1945 will improve the situation, but only about 50 percent had been arranged for at the time plans for allocation were announced.

Step-Up in Aluminum Ingot Production

The ten million pound increase in monthly aluminum ingot production which was undertaken early in February was the result of a need for virgin metal. Present metallurgical practices are to produce aluminum alloys in the pots of the reduction plants. Virgin metal is needed to bring these alloys to the proper analysis and to sweeten some of the scrap being remelted.

The increased production was scheduled for the Alcoa mills at Massena, N.Y., Badin, N.C., and Niagara Falls, N.Y., and for the DPC plant at Spokane, Wash. Four million pounds of the increase is to come from the Alcoa operations and six million pounds from the DPC plant at Spokane. Selection of the exact plants at which operations were to be increased presented a difficult problem. The leading consideration was the availability of labor, followed by fuel, existing contracts, and availability of power, in about that order of importance. The very great shortage of labor in areas where there were reduction plants in partial operation prevented the scheduling of an increased production at these points, even though power might be available. Because of fuel shortages, operations had to be resumed only where hydroelectric power was available.

Announcement that a thousand soldiers would be furloughed to work in aluminum products plants was misunderstood by some to mean that the labor problems at the reduction plants would be solved in this manner. That is not the case. Furloughed soldiers were being sent to the Alcoa mills in Tennessee during the last half of February to meet the stepped-up demand for aluminum products by the new military production schedules. None of the new ingot production is in that area.

Bills Introduced to Extend Premium Plan

A move to make possible an early announcement of the extension of the premium-quota plan for another year was made by the introduction in early February of enabling legislation in both houses of Congress. Identical bills were introduced into Senate and House.

The bills were written to make inoperative the last paragraph of Section 2 (e) of the Stabilization Act for the fiscal year ending June 30, 1946, which reads:

"After June 30, 1945, neither the price Administrator nor the Reconstruction Finance Corporation nor any other government corporation shall make any subsidy payments, or buy any commodities for the purpose of selling them at a loss and thereby subsidizing directly or indirectly the sale of commodities, unless the money required for such subsidies, or sale at a loss, has been appropriated by Congress for such purpose; and appropriations for such purpose are hereby authorized."

The amount designated in the bills is that shown to be necessary by past experience. It includes not only the estimated loss that will occur in the continuance of the premium-quota plan for copper, lead, and zinc, but also includes the amount that will be necessary to keep the oil subsidies going.

Bills were sent to the Banking and Currency committees of both houses.

Lead Product Imports Placed Under Control

Government control over lead was made complete when restrictions on imports of three important manufactured lead items were made in mid-February. The importation of collapsible tubes, filled or empty, whether made in whole or in part of lead or lead alloy, lead acid-type storage batteries, and foil in which lead is a component part, was banned. This prevents private purchasers from draining off lead which the government would buy from foreign producers.

In Mexico, for instance, all the lead over and above the needs of the people of the sister republic on the south is purchased by this country. The private purchase of any of the lead items placed under import control if made in Mexico would result in a decline in the amount of lead this government could purchase by the exact amount used in the manufacture of the items that were purchased.

New Bureau of Mines Divisions Are Announced

The field organization of the mining and metallurgical branches of the Bureau of Mines was established in an Executive Order dated Feb. 17, 1945. The metallurgical branch of each field division will be responsible for research "on the conservation, preparation, and utilization of metals and nonmetals," including ore dressing. The field divisions of the mining branch will take charge of engineering examinations and exploratory projects for the purpose of discovering and proving additional deposits of critical and essential minerals. The work of the mining branch will also develop improvements of operations in existing mines. Work in fuels and helium is not included.

The metallurgical and mining branches will each have a branch chief in Washington, to whom the field division chiefs will report. L. B. Moon has been designated as chief of the mining branch, with G. D. Jermain as assistant. The chief of the metallurgical branch is to be R. G. Knickerbocker, with O. C. Ralston assistant chief. Field divisions and their headquarters are as follows:

A. Alaska Division, comprising the Territory of Alaska, with headquarters to be designated by the Director.

B. Albany Division, comprising the States of Washington, Oregon, Idaho, and Montana, with headquarters at Albany, Oregon.

C. Boulder City Division, comprising the States of Nevada and California, with headquarters at Boulder City, Nev.

D. Salt Lake City Division, comprising the States of Utah, Wyoming, and Colorado, with headquarters at Salt Lake City, Utah.

E. Tucson Division, comprising the States of Arizona, New Mexico, and Texas, with headquarters at Tucson, Arizona.

F. Minneapolis Division, comprising the States of North Dakota, South Dakota, Nebraska, Minnesota, Iowa, Wisconsin, and Michigan, with headquarters at Minneapolis, Minn

G. Rolla Division, comprising the States of Kansas, Oklahoma, Missouri, Arkansas, Illinois, and Indiana, with headquarters at Rolla, Mo.

H. Tuscaloosa Division, comprising the States of Louisiana, Mississippi, Alabama, and Florida, with headquarters at Tuscaloosa, Ala.

I. College Park Division, comprising the States of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Ohio, West Virginia, Maryland, and Delaware, with headquarters at College Park. Md.

J. Raleigh Division, comprising the States of Virginia, Kentucky, Tennessee, North Carolina, South Carolina, and Georgia, with headquarters at Raleigh, N.C.

No announcement had been made as to who would be the field division chiefs at the time this issue of Engineering and Mining Journal went to press.

Liability of WPB Remains in Doubt

Official attitude of the War Production Board is that the organization is not liable for claims under Section 17 of the Contract Settlement Act of 1944 dealing with defective, informal, and quasi contracts, except for claims that can be made against the Office of Production Research and Development. OPRD is the only division of the War Production Board for which Congress has appropriated money to be used in the purchase of material or services for the government. It is the WPB contention that except for claims that can be made against OPRD, it has no means of providing remedies for disappointment or financial distress of those who believe they have a claim against the government under Section 17.

In spite of the official attitude, WPB is complying with legal requirements by establishing machinery to handle claims under Section 17. The Board, however, does not have any money to satisfy any claim if it is found to be just. In the final analysis, it will be up to Congress to provide funds. Evidence as to whether mine operators will be able to collect on claims against WPB under Section 17 probably will be found in the future appropriations for that agency.

In the meantime, senators and congressmen from the mining states are continuing pressure to bring WPB into line with what they believe to be the intent of the Act. One of the latest moves was made by Senator Murray, of Montana, who asked Robert H. Hinkley, Director of Contract Settlement, "whether the procedure outlined in this regulation (Section 17, Contract Settlement Act) applies to claims against the War Production Board."

In acknowledging this inquiry, Mr. Hinkley said, "In the opinion of this office, the regulation applies to all contracting agencies authorized to make contracts pursuant to Section 201 of the First War Powers Act, 1941, including the War Production Board, which is specifically designated as a contracting agency in Section 3 (g) of the Contract Settlement Act."

Senate Hearings Planned on Light-Metal Future

Senator Murray, of Montana, has announced that the Committee on Small Business will begin hearings Feb. 27 on war development and postwar uses of aluminum and magnesium.

How the government's huge investment is to be disposed of to stimulate healthy competition, strengthen the existing small-business system, and insure many new firms entering this field, underlies the committee's efforts.

In addition to the employment goal, the committee will direct its inquiry toward anti-monopoly aims, and will study the small-enterprise potentialities, believed especially great in the fabrication of aluminum and magnesium.

Characterizing the temper of the committee's inquiry, Senator Murray said: "This is to be no witch hunt, but the cooperative effort of private industry, big and little, with government to develop the full facts surrounding the light-metals industries and the problems of disposing of the government's huge holdings in them."

Stockpile Recommendations Released in Part

The report on strategic materials by the Army-Navy Munitions Board contains a discussion of the necessity for stockpiling, recent stockpile history and legislation, and the development of stockpile policy, before it makes its recommendations of quantities and materials to be stored.

Actual recommended quantities are confidential information, but the materials recommended for stockpiling are those in the current list of strategic and critical materials approved by the Board last November.

Group A comprises those strategic and critical materials for which stockpiling is deemed the only satisfactory means insuring an adequate supply for a future emergency. This group includes: antimony; Rhodesian chrysotile, and South African amosite asbestos; bauxite, bismuth, cadmium; celestite; chromite; cobalt; columbite; copper; corundum; industrial diamonds, graphite, amorphous and flake; kyanite, Indian; lead; manganese ore, metallurgical and battery grades; mercury; mica, good stained and better; monazite; nickel; iridium and platinum; rutile; sapphire; ruby; talc, steatite, block or lava; tantalite; tin; tungsten; vanadium; zinc; and zirconium ores.

Group B comprises additional strategic and critical materials the stockpiling of which is practical, but the Army and Navy Munitions Board recommends their acquisition only to the extent they may be made available for transfer from government agencies, because adequacy of supply can be insured either by stimulation of existing North American production or by partial or complete use of available substitutes. This group includes: aluminum; barite; chalk, English; chromite, chemical grade; cryolite, natural; emery; fluorspar, acid and metallurgical grades; magnesium; mica, stained and lower grade; molybdenum; osmium; palladium; rhodium; ruthenium; selenium; talc, steatite, ground.

Group C comprises those strategic and critical materials which are now recommended for permanent stockpiling, because in each case difficulties of storage are sufficient to outweigh the advantages to be gained by this means of insuring adequate future supply. This group includes: asbestos; Canadian chrysotile; iron ore, radium, scrap iron and steel.

"The list of the materials in groups A, B, and C," says the report, "does not imply that materials in any one group

(*Continued on p. 154*)

NEWS OF THE INDUSTRY

Postwar Mineral Position Discussed Before A.I.M.E.

Dr. Alan M. Bateman, director of the Metals and Minerals Division, Foreign Economic Administration, spoke on "Postwar Position of World Minerals," and Elmer W. Pehrson, chief of Economics and Statistics Branch, U. S. Bureau of Mines, discussed "The Mineral Position of the United States," at a meeting of the New York Section of the A.I.M.E. which was held on Feb. 19. Members were greeted by Chester A. Fulton, retiring president of A.I.M.E., and H. S. Mudd, newly elected president. M. B. Gentry, chairman of the New York Section, introduced the speakers.

Dr. Bateman stated that early in the war the State Department and Metals Reserve Co. cooperated to acquire foreign strategic minerals. Spot purchases were first made, and, later, purchase contracts were drawn up with protective clauses to cover risks assumed by producers. No loans as such were made, but advances against future deliveries were necessary. He revealed that foreign minerals are now being purchased by U.S. government and private agencies at the following annual rates in tons: manganese ore, over 1,000,000; chrome, over 750,000; zinc metal and metal in concentrates, 400,000; refined lead and lead in concentrates, 300,000; and copper, 1,000,000.

Foreign attitudes are changing, according to Dr. Bateman, because of rising inflation, higher production costs, lower profits, and decreased tax yields. He stated that nationalistic tendencies are growing as well as demands for domestic use of minerals produced. Expanding industrialization is limited only by shortages of machinery and equipment.

Wherever possible, he stated, our government has withdrawn from public purchase of minerals, including mercury, antimony, cobalt, tungsten, chromium, molybdenum, columbite, tantalite, vanadium, asbestos, and rutile.

Dr. Bateman expressed the following views on the position of major metals:

Copper production has expanded in Canada, Chile, Peru, Mexico, Rhodesia, and South Africa. World production will exceed postwar needs and probably will have to be curtailed. The U.S. will not need to import copper during the early postwar period but may have to do so later. Canada will be in a strong position to compete with Chile.

Zinc production has increased in Canada, Mexico, Peru, and Australia. The U.S. will have to import 40 percent of its future needs, and because of available smelter capacities, should be able to import concentrates for foreign as well as domestic markets. Foreign producers are now operating at capacity, and will be able to supply foreign postwar demands and our import needs.

No important new lead mines have been discovered in non-Axis countries. Higher prices have stimulated production increases in Mexico, Canada, Peru, and Bolivia. We must look increasingly to foreign producers for future supplies. Future production will be ample for foreign and domestic needs if favorable prices are maintained.

U.S. Mineral Self-Sufficiency and Reserves

	Percent Self-Sufficiency[1]	Commercial Reserves,[2] (Years' Supply)	Submarginal Resources,[3] (Years' Supply)
Molybdenum	290	422	100–500
Magnesium	160	Indef.	Over 500
Phosphate rock	151	805	Over 500
Sulphur	142	55	Over 500
Copper	107	34	5–25
Salt	101	Indef.	Over 500
Iron ore	94	111	Over 500
Zinc	93	19	5–25
Fluorspar	92	40	5–25
Barite	89	...	.....
Lead	88	12	0–5
Nitrogen	78	Indef.	Over 500
Cadmium	70	16	5–25
Mercury	65	3	5–25
Potash	61	117	Over 500
Bauxite	55	9	100–500
Vanadium	53	7	100–500
Tungsten	31	4	5–25
Platinum	28*	4	0–5
Block mica	18	...	5–25
Antimony	11	4	0–5
Manganese	5	2	100–500
Asbestos	4	3	5–25
Nickel	1	−1	5–25
Chromite	−1	1	5–25
Tin	−1	−1	0–5
Quartz crys.	0	0	0–5
Fl. graphite	0	0	25–100
Gold	...	14	5–25
Silver	...	11	5–25

[1] U.S. production expressed in percentages of domestic consumption, 1935–39.
[2] Supply of commercial reserves remaining as of 1944 expressed in terms of years' life at average annual rate of consumption 1935–39.
[3] Rough quantitative appraisal of highly speculative submarginal mineral resources in the United States as of 1944. They do *not* include commercial reserves. Years of supply based on average annual rate of consumption 1935–39.
* Platinum metals.

Dr. Bateman concluded that highly increased mineral production can compensate for our own depletion, and that America must expand foreign trade and will have to learn to import in the future. He looked for a general return of mineral trade to private enterprise, but stated that government participation and assistance would be necessary in the international field.

Stating that mineral resources were vital to our industrial and military power, Mr. Pehrson refuted extreme views that we are either a "have-not" or a "have" nation, presenting charts which showed that we have abundant resources of some basic minerals, and that exhaustion is well advanced in a number of important subsidiary minerals. The accompanying table has been compiled from the charts which were based on statistics supplied by the U.S. Bureau of Mines and the U. S. Geological Survey. The estimates tabulated represent preliminary figures only.

Stressing the importance of large-scale stockpiling for national defense, Mr. Pehrson suggested that they be made up largely from imported materials. As a second line of defense he recommended the development of marginal and submarginal resources.

The theory of shutting down mines to conserve resources is impractical, he said, because unmined portions of many deposits now developed probably never could be recovered after a prolonged shutdown. He stressed the importance of keeping the mining industry going in peacetime so that it could function in time of emergency.

He called attention to the pronounced trend toward reduced tariff barriers, and stated that it would be economical to discontinue tariffs on those minerals which are being produced in minor quantities. He suggested that the prewar tariffs on copper, lead, and zinc be maintained for a five-year period, and then reduced gradually.

NEWS BRIEFS

"Archaic Hard Money Views." When the American Bankers Association recently proposed that the International Monetary Fund of the Bretton Woods plan be eliminated, the Financial News of London replied that the proposed alternate scheme of a purely American controlled institution "under the direct aegis of American bankers, with their archaic hard-money views, would not have the slightest chance of being accepted" by the British.

Chinese Wolfram Center Captured. Namyung, in Kwangtung, a center from which wolfram has been flown to the United States, has been captured by the Japanese, according to an announcement of the Chinese High Command on Feb. 6.

Zinc Meeting Called Off. The annual convention of the American Zinc Institute, which is generally held in St. Louis in April, will not take place this year. It is expected, however, that active members and directors will meet in New York in April to comply with bylaws of the association.

Fast Ore Ships. The War Shipping Administration recently announced that a fleet of the largest and fastest ore ships in the world is being built at Baltimore to carry high-grade iron ore exclusively, most of it from Chile. Southbound cargo will be coal and limestone.

Many Industry Problems Discussed At Colorado Mining Convention

At its annual convention at Denver on Jan. 25, 26, and 27, the Colorado Mining Association was urged to make an unprecedented effort to produce the metals essential for war, particularly lead and cadmium, but was warned that the mining industry would probably be unable to obtain additions to its total manpower supply.

The opening session was devoted to health and safety. In discussing "Safety in Producing Metals for War," W. E. Jones, safety engineer of Climax Molybdenum Co., said that the company, through an all-out safety program, had achieved a frequency rate of 12.08 lost-time accidents per million man-hours in 1944, and a severity rate of 0.51, compared with a 1943 national average for metal mines of 24.21 and 6.27 respectively.

W. L. Haines, manager of Safety Claims Service, Chicago, outlined a procedure to meet the requirements of occupational disease insurance: First, a survey followed by constant work to prevent dust incidence and provide adequate ventilation; second, chest and general health examinations for the employee at the start of employment and during its tenure; and third, an adequate record system.

Discuss Aluminum Therapy

At the luncheon meeting, Dr. J. W. G. Hannon, medical director, McIntyre Research, and A. W. Jacobs, ventilation engineer of McIntyre Porcupine, described the use of aluminum dust in preventing silicosis. Dr. Hannon presented conclusive evidence that the proper use of aluminum dust not only prevents silicosis, but also partly abates some of its symptoms. Mr. Jacobs described the method used in dispersing the aluminum in changehouse atmospheres.

H. P. Rue, U.S. Bureau of Mines, Laramie, Wyo., read "The Oil-Shale Program of the U.S. Bureau of Mines," a paper jointly prepared by himself and A. J. Kraemer, chief of the oil-shale section of the Bureau.

Speaking on "Metals and Minerals of the Future," John D. Sullivan, assistant director of Battelle Institute, Columbus, Ohio, forecast an increased use of heavy metals and described the importance of scrap in the steel, copper, lead, zinc, glass, and ceramic industries.

Ira B. Joralemon, consulting geologist of San Francisco, discussed "Our Mineral Reserves." His contention was that we are able to, and should, maintain mineral self-sufficiency, except for chrome, manganese, tin, and nickel. He emphasized the importance of technological progress in promoting conservation and stated that higher metal prices and lessened taxes will be necessary to maintain a healthy domestic industry, as technology cannot be expected to make up for more than a fraction of labor cost increases. He stated that, with 6 percent of the earth's population, we own 20 percent of its original ultimate mineral reserves. He believes that foreign mineral reserves being limited, any important dependence of our economy on them would quickly deplete them to about the same status as our own, and that this could only prolong our own reserves for a decade or two.

Carl H. Wilken, of the National Association of State Agriculture Commissioners, urged the mining industry to form a raw-material bloc with the farming interests in order to secure for all raw materials the parity prices already legislated for some farm products.

Major Gen. William E. Shedd, addressing the meeting on "The War Department's Message to the Mining Industry," called attention to the vital importance of metal supplies, particularly lead and cadmium, and urged a supreme effort to produce.

Ford Shepard, of the War Manpower Commission, warned mine operators that despite strong efforts to provide additional manpower, they cannot expect more total manpower than they now have.

Charles Taft, Assistant Secretary of State, warned that high-cost production must be tapered off after the war, but promised that the State Department would not seek to favor foreign producers over domestic industry.

Leading a panel of gold producers, Merrill E. Shoup, president of Golden Cycle Corp., complained about gold-mine closing Order L-208, and urged that gold producers get together to study joint future problems and hire some specialized talent for this purpose. Worthen Bradley, Bradley Mining Co., speaking for Northern California gold producers, expressed their unwillingness to join a general effort, but stated that they might act similarly but independently.

J. L. Robison, of U.S. Vanadium Corp., said that vanadium needs are becoming more evident with resumption of Lend-Lease shipments, and after the closing of two government plants at Monticello, Utah, and Durango, Colo.

C. J. Abrams, of Climax Molybdenum Co., emphasizing the need for cooperation to insure postwar employment in the mountain region, suggested that all elements of the mining industry, including labor, should join for this purpose under the auspices of the Colorado Mining Association.

George H. Teal, of Boulder, Colo., said that the tungsten mining industry of Boulder County is largely closed down, due to the withdrawal of government premiums for tungsten.

Addressing the Annual Gold and Silver Banquet, William Murphy, of New York City, urged a return to gold and silver-backed currencies. Robert S. Palmer, secretary of the Colorado Mining Association, was presented with a gold watch in recognition of his services.

Opening the third day's session, Robert Wamsley, of Climax Molybdenum Co., described its $100,000 installation for purifying mine waters for domestic use. H. G. Fisk, director of the Natural Resources Research Institute, University of Wyoming, outlined a program to promote utilization of Wyoming minerals, including phosphates, leucite, titaniferous magnetite, trona, and coal. A. S. Walter, consulting engineer of Socorro, N. M., listed operations producing carbon dioxide, oil and gas, potash, zinc, copper, molybdenum, selenium, indium, fluorspar, and coal, in New Mexico.

Zinc Panel Meets

At a zinc panel discussion presided over by E. H. Snyder, of Salt Lake City, Ernest V. Gent, secretary of the American Zinc Institute, called attention to the performance of the industry in meeting all essential requirements, and pointed to upward trends in galvanizing and brass making.

Contradicting the idea of mineral have-notism, stemming from manufacturers seeking foreign markets, Mr. Snyder called on operators from four Western areas, all of whom testified that they could increase production from 40 to 50 percent, given adequate manpower. Snyder stated that, based on present wage rates and 1939 efficiency, a 9c. zinc price would be necessary to maintain Western zinc mining in a healthy condition.

At a luncheon, Representative Frederick C. Smith, of Marion, Ohio, denounced the world monetary proposals framed at Bretton Woods, as solely designed to use America's sound credit and currency to bolster up the currencies and economies of less fortunate countries.

Secretary Julian D. Conover of the American Mining Congress discussed taxation proposals, and read a paper by Henry B. Fernald, of New York City, declaring lighter postwar taxes are necessary for a fully productive economy, and that in particular the excess-profits tax should be repealed and corporate and personal income taxes reduced to a top of not more than 50 percent.

Felix Wormser, secretary of the Lead Industries Association, described the change in status of lead, from a condition of abundance to one of dangerous shortage, and predicted that essential needs could not be met without drastic cuts in civilian usages, particularly of white lead.

In a panel discussion of silver, led by B. T. Poxson, of Creede, Colo., James White, of Washington, D.C., described the Mexican system of maintaining domestic silver values by control of foreign exchange. Sr. Victor Urquidi, of the Mexican Ministry of Finance, described the importance of silver to the economy and its popularity as coinage.

PERSONAL NEWS

Charles A. Mitke and **Mrs. Mitke,** of Los Angeles, were reported by the War Department on Feb. 20 as among those recently liberated in the Philippines by the American forces.

William F. Boericke, chief engineer of the Philippine Bureau of Mines, a prisoner of the Japanese in Santo Tomas concentration camp until delivered recently by United States and Filipino troops, is reported by the *New York Herald Tribune* of Feb. 13 to be safe at Santo Tomas University and to be recovering from beri-beri. Mr. Boericke, 59, who has lost 50 pounds since his internment, has nevertheless taught a course in mining to Santo Tomas seniors and has organized a camp garden, which has contributed materially to the well-being of his fellow prisoners. Before going to Luzon in 1938 he was senior valuation engineer for the Securities and Exchange Commission at Washington, D. C.

George G. Schallenberger has resigned as secretary of trustees and director, secretary-treasurer, and manager of the Great Northern Iron Ore Properties. He will continue to serve as president of the Lake Mining Co., which is operating the Embarrass mine, on the Mesabi Range.

Albert W. Goodwin, who has been connected with the U. S. Geological Survey office at Santa Fe, New Mexico, for a number of years, has been made associate engineer of the Survey's office at Asheville, N. C., succeeding **Raymond Leonard,** who resigned the post last September.

Glenville A. Collins, consulting engineer, has opened offices at 914 Royal Bank Bldg., Vancouver.

Howard T. James has been re-elected chairman of the Mining Bureau of the Vancouver Board of Trade for 1945. Dr. James was also recently re-elected president of the Mining Association of British Columbia.

Lt. Col. E. M. Thomson has been elected president of Grull-Wihksne Gold Mines, Ltd., and Bayonne Consolidated Mines, Ltd., both in British Columbia. **Sir Henry Drayton** has been added to the directorate of Grull-Wihksne.

H. L. Batten has returned to Vancouver after several years in the service of the British Admiralty at Washington and New York. He has reopened his former office in the Royal Bank Bldg., Vancouver.

H. G. Washburn, of Wallace, Idaho, general manager of the Federal Mining & Smelting Co., spent several days the latter part of January and the first part of February in the Tri-State, conferring with **L. G. Johnson,** of Baxter Springs, district superintendent of the company.

R. L. Heath recently joined the Climax Molybdenum Co. as metallurgical engineer. His headquarters are in St. Louis, Mo. Before becoming

R. L. HEATH

a member of the Climax staff he was chief metallurgist of the Allison Division of General Motors Corp. at Indianapolis, Ind.

Chester A. Fulton has resigned as president of the Southern Phosphate Corp., one of the larger producers of raw phosphate rock in the Florida pebble field, with main offices in New York. He has been the chief executive of his company for the past 17 years and retires to engage in private practice as mining engineer. He has been honored by the industry as president of the Phosphate Rock Institute, and by his profession as president, for 1944, of the American Institute of Mining and Metallurgical Engineers.

Herman L. Dauth has resigned as consulting engineer for the Hochschild interests in Bolivia and has been appointed general manager for the Compañia Minera Santa Maria del Oro, S. A., a subsidiary of International Mining Corp. of New York, that operates a copper-gold property in Durango, Mexico. Mr. Dauth succeeds **Murray F. Crossette,** resigned.

Paul M. Tyler, formerly Regional Eastern Engineer of the U. S. Bureau of Mines at College Park, Md., has accepted a temporary assignment with the American Mining Congress.

Dr. K. R. Miles, a member of the Geological Survey of Western Australia, has been appointed assistant government geologist for South Australia.

William F. Hayden, consulting mining engineer, recently returned to his St. Louis, Mo., office after an extended visit to San Francisco on professional work for St. Louis clients.

Walter Hull Aldridge, president of Texas Gulf Sulphur Co., and **Walter Curren Mendenhall,** retired director of the U. S. Geological Survey, were named honorary members of the A.I.M.E. at the meeting of the Institute directors held on Feb. 20.

Robert Franklin Mehl, director of the medals research laboratory and head of the department of metallurgical engineering of Carnegie Institute of Technology, Pittsburgh, Pa., was on Feb. 20 awarded the 16th James Douglas Gold Medal by the board of directors of the A.I.M.E., "for distinguished achievements in physics and physical metallurgy; and especially for his development of gamma-ray radiography and for conspicuous success in his metallurgical investigations involving diffusion and crystal structures."

S. M. "Mac" Manning, formerly with Premier Gold Mining Co., Ltd., at Premier; Relief-Arlington, and in Saudi Arabia, and latterly on the staff of Stormont Chemical Co., Ltd., at Cornwall, Ont., has been engaged as general superintendent by Cuyuni Goldfields, Ltd., and has taken passage to British Guinea. **F. C. Tomlinson,** recently discharged from the R.C.A.F. and formerly on the staff of Conwest Exploration Co., Ltd., and with the Timmins interests, and **Ralph Sinke,** efficiency engineer at Bralorne, have been added to the engineering staff. **Walter Tattrie,** formerly mine superintendent at Relief-Arlington, is now at the Cuyuni property in a similar capacity.

R. E. Legg retired in December with the rank of Squadron Leader after a lengthy service in the R.C.A.F. He is now in charge of the office of Conwest Exploration Co., Ltd., at 401 Rogers Bldg., Vancouver.

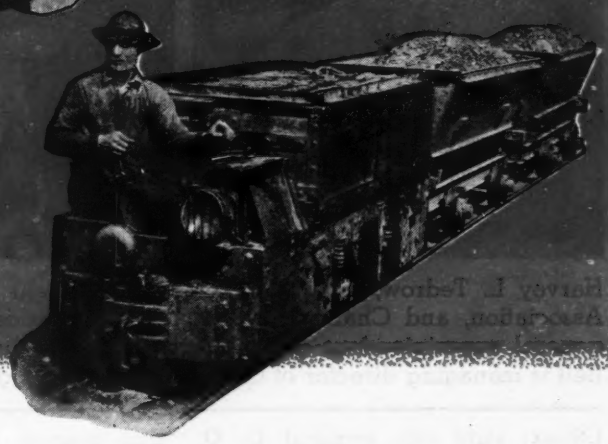
H. J. LaRonde has been made manager of Sullivan Consolidated Mines, Ltd., Abitibi, Que.

D. H. Wilsden, previously in charge of the electrolytic refinery of Mount Lyell Mining & Railway Co., Ltd., Tasmania, has been appointed metallurgist to the company.

Dr. S. W. Carey has been appointed government geologist for Tasmania.

A. J. Keast, formerly manager of several prominent mining properties and since 1936 manager of Zinc Corp. at Broken Hill, N.S.W., has been appointed to the Federal Australian Government's advisory panel, which will advise the government of Australia

POWER



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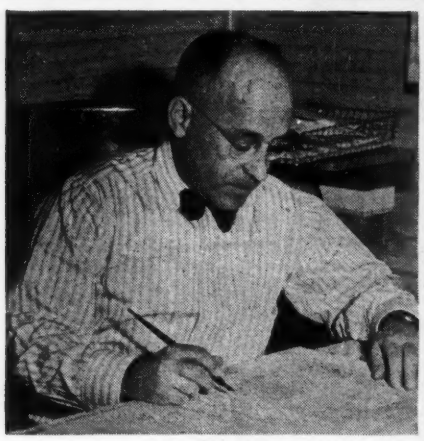
on the development of that continent's mineral resources.

C. J. Calvin, who has long been chief engineer for the Great Northern Iron Ore Properties and in charge of that organization's office at Hibbing, Minn., has been promoted to be vice president of the Arthur Iron Mining Co., Great Northern subsidiary.

Harvey L. Tedrow, of Denver, has been elected president of the Colorado Mining Association. Other recently elected officers are: First vice president, **Judge B. T. Poxson** of Creede, Colo.; second vice president, **C. J. Abrams,** Climax; third vice president **C. Q. Schlereth,** Denver; fourth vice president, **Merrill E. Shoup,** Colorado Springs; fifth vice president **John Hamm,** Leadville; treasurer, **Clarence Withrow**; executive secretary, **Robert S. Palmer.**



Harvey L. Tedrow, left, newly elected president of Colorado Mining Association, and Charles N. Bell, retiring president. Mr. Tedrow is general superintendent of London Mines & Milling Co., Alma. Mr. Bell is managing director of Camp Bird Mine, King Lease, Inc., Ouray.

William H. Brady, treasurer of American Metal Co., Ltd., on Feb. 3 last completed 50 years of service with the company. A luncheon was given in his honor to commemorate the event, at which Dr. Otto Sussman, chairman of the board, presented him with a silver platter and a copy of resolutions of appreciation and congratulation adopted by the board.

Robert P. Porter, of Helena, Mont., has been chosen president of the Mining Association of Montana. He succeeds **John Hickey,** of Philipsburg. **W. R. Allen** was named first vice president, **K. D. Lynn** second vice president, and **Carl J. Trauerman** was re-elected secretary-treasurer.

Harry Hey, technical superintendent and a director of Electrolytic Zinc Company of Australasia, Ltd., has returned to Australia from a visit to the United States of America and Canada.

Hugh M. Murray, formerly mill superintendent to Mount Lyell Mining & Railway Co. Ltd., Tasmania, has been made general superintendent of the company.

Philip L. Ray, of St. Paul, Minn., has been elected president of the trustees of Great Northern Iron Ore Properties, succeeding **Louis W. Hill,** resigned.

Dr. Norman Ross Junner, director of geological survey of the Gold Coast, Africa, has been awarded the Lyell Medal by the Geological Society of London. Dr. Junner is a graduate of the University of Melbourne.

Glenister Shiel, who has been chief civil engineer for the Hydroelectric Commission of Tasmania, has been appointed assistant general manager of Mount Morgan Ltd., Queensland.

E. E. Brisbane has been appointed assistant state mining engineer for Western Australia. He was previously ventilation officer for the Department of Mines and an inspector of mines at Kalgoorlie prior to enlisting in the A.I.F.

Dr. I. W. Wark, chief of the Division of Industrial Chemistry in the Council for Scientific and Industrial Research, has been appointed a member of the Australian Aluminium Production Commission. **W. H. Williams,** director of mines, Tasmania, is also a member of the Commission.

Perry G. Harrison, president of Evergreen Mines Co., Crosby, Minn., has been appointed ore sales manager of M. A. Hanna Co., which has acquired a substantial stock interest in the Evergreen company. Mr. Harrison will be located at Cleveland but will retain his present home and office at Crosby. Under the new arrangement he will remain president of Evergreen, with which he has been connected since 1927, and the Hanna company will manage the Evergreen iron ore properties. The interest acquired by M. A. Hanna was purchased from the estate of Donald R. McLennan, of Chicago. A few weeks ago it was announced that the Hanna interests had purchased one-third of the Evergreen company's Cuyuna Range reserves, together with its big sintering plant.

Russell H. Bennett, of Minneapolis, has been elected chairman of the Minnesota Section of the A.I.M.E. **Lloyd M. Schofield,** of Duluth, was chosen as vice chairman and **R. H. B. Jones,** also of Duluth, was reelected secretary-treasurer.

Prof. John Orr, director of Witwatersrand Technical College, after more than 40 years spent in furthering technical education in South Africa, retired early this year. Born in Scotland, he had a brillant scholastic career and graduated in engineering with honors from Glasgow University. He had wide experience in engineering before going to South Africa, in 1897, to the first South African School of Mines. He is a past president of the South African Institution of Engineers and has the distinction of being the first professor of engineering appointed to a South African institution.

Olaf N. Rove, mining geologist, formerly with the Ferro-Alloy Division of WPB, is making special studies of iron-ore deposits for Pickands, Mather & Co., of Cleveland, Ohio.

Ernest Craig, who had long been on the staff of Falconbridge Nickel Mines, recently resigned as mine manager and has become associated with Ventures, Ltd., in a consulting capacity.

John W. McBean has been appointed resident geologist of Ontario Department of Mines for the Kirkland-Larder Lake area.

H. W. Chadbourne has resigned as president of International Mining Corp. of Canada, Ltd., and has been succeeded by **Donald B. Douglass,** who is also president of the parent company, International Mining Corp., with headquarters in New York.

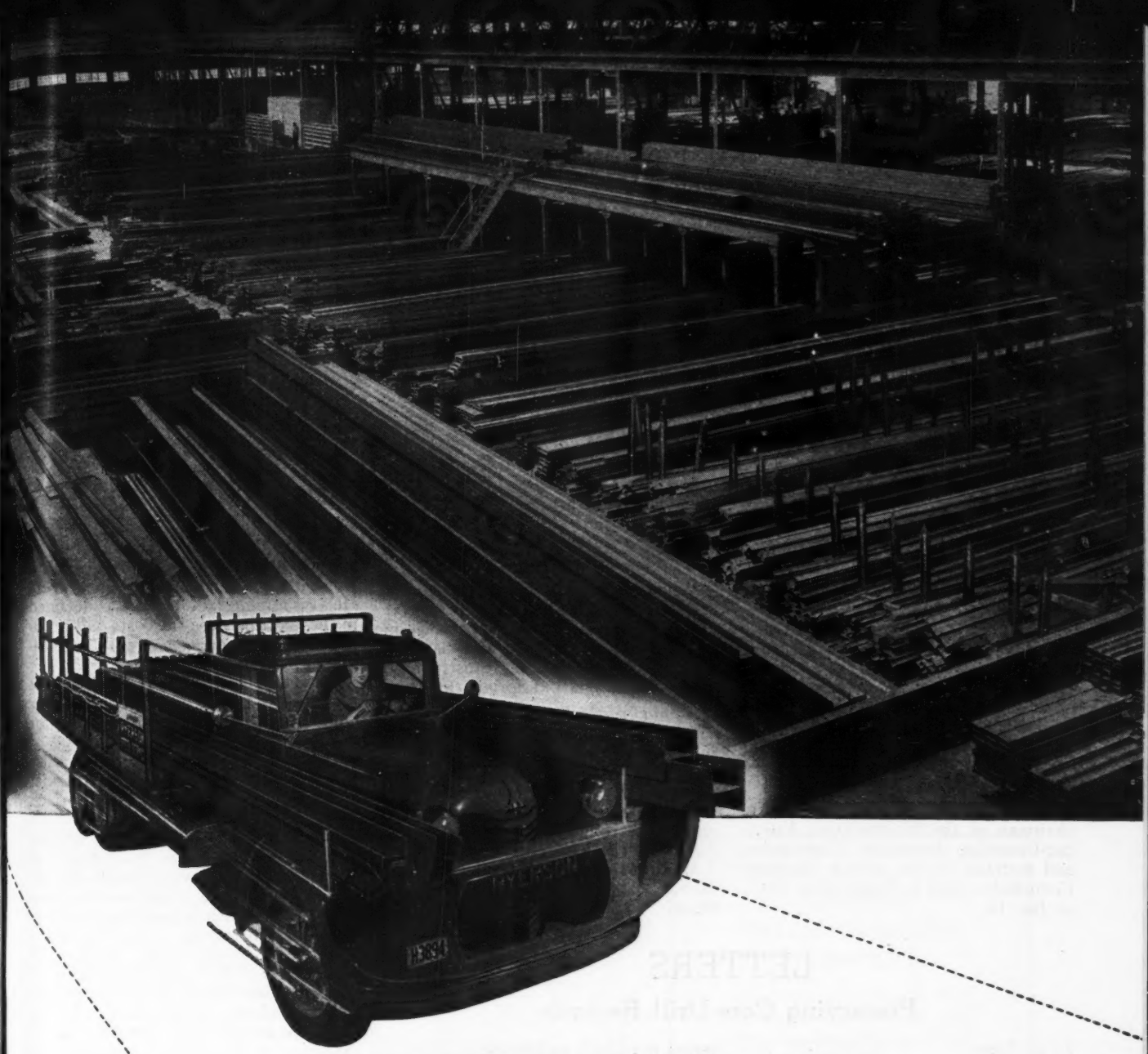
D. C. Hitchings has left England for India to join the staff of Mysore Gold Mining Co.

Leslie G. R. Crouch has been appointed Mining Engineer and Inspector of Mines for the Mines Branch of the Manitoba Department of Mines and Natural Resources at Winnipeg, succeeding **W. S. Paton,** who resigned some time ago to go with the Dominion Bureau of Explosives at Ottawa. Mr. Crouch has previously been on the engineering staff of Hudson Bay Mining & Smelting Co.

J. W. Bannister has been appointed metallurgical engineer for British Copper Refiners, Ltd.

H. A. Cochran has been appointed deputy Chief Inspector of Mines for Nigeria.

Dr. R. C. Benner, director of research for The Carborundum Co. for the past



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18 years, retired Jan. 1. He is the holder of more than 250 patents, covering not only the field of abrasives, refractories, and electric furnaces but also dry cells, smoke screens, and sulphur recovery. He will continue research work from 460 College Ave. Niagara Falls, N. Y.

OBITUARIES

Charles William Henderson, of Denver, Colo., chief of the Western offices of the Metal Economics Division of the Bureau of Mines and for more than 30 years a nationally known figure in the mining world, died at Mayo clinic, Rochester, Minn., on Jan. 26, at the age of 59. An appreciation of the life, career, and achievements of Mr. Henderson will appear in an early issue.

Arthur Jellinek, of New York, importer and exporter of metals, died on Jan 26 at the age of 51.

Charles G. Knott, 77, pioneer mining man of Matachewan and Red Lake areas of Canada, died on Jan. 14 in Toronto.

James Benjamin Taylor, Rand pioneer and one of the founders of the South African Chamber of Mines, died recently at Cape Town at the age of 84.

Stephen Kreyns, a metallurgist at the Perth Amboy plant of the American Smelting & Refining Co., died at Perth Amboy on Feb. 8 at the age of 44.

Thomas Riggs, ex-Governor of Alaska, chairman of the International American-Canadian Boundary Commission and member of the Alaska Highway Commission, died in Washington, D.C., on Jan. 16.

Charles Lewis Crockwell, 74, who had been in charge of the Honerine and Black Diamond mines, at Stockton, Utah, for Bullion Coalition Mines Co., died Jan. 22 in Salt Lake City.

Jack Dalton, 89, famed blazer of the pioneer "Dalton Trail" from Haines to Selkirk and Fiver Finger Rapids, on the Yukon, died in San Francisco Dec. 16.

Eugene C. Tousley, 78, died in Spokane Jan. 28. He organized the original Sunshine Mining Co. in 1913, and acquired the Coeur d'Aene property which became the Sunshine mine.

William Mitchell Gardella, long a sales engineer associated with Oliver United Filters, Inc., as a specialist in the analysis of filtration and clarification problems and filter construction, died on Jan. 26 last at Springfield, Ohio.

Adolfo Prieto y Alvarez de las Vallinas, 77, one of Mexico's most prominent mining executives, for many years president of the Cia. Fundidora de Fierro y Acero de Monterrey, S.A., Monterrey, Nuevo Leon, and board member of its allied enterprises, Siderugica de Monterrey, S.A., and the Cia. Cerro de Mercado, S.A., Durango City, died at his home in Mexico City on Jan. 11 after a long illness.

LETTERS

Preserving Core-Drill Records

To the Editor:

I WAS VERY INTERESTED to read in the April and May issues, 1944, of E.&M.J., two articles on Better Drill-Core Records by Charles A. Dobbel, Associate Professor of Mining, Stanford University, Palo Alto, Calif.

May I take this opportunity of congratulating Mr. Dobbel on his excellent papers. I agree with him, in that better drill-core records are vitally necessary to the mining industry. Mr. Dobbel's method of preserving drill-core records for posterity is extremely valuable and interesting, but may I say a little involved and expensive. One would require to have a considerable knowledge of photography and considerable time and energy would be expended in thus classifying all drill cores recovered. A large number of mines and operators cannot afford the time and expense for such a detailed classification as laid out by Mr. Dobbel.

A far simpler and less expensive method of preserving drill-core records is by what is known as "skeletonising." This practice was used successfully at Mt. Isa Mines, Ltd., Mt. Isa, Queensland, where for some years the writer was staff geologist. Mt. Isa drill-core record practice is as follows:

The drill core is brought to the surface in wooden boxes 5 ft. long by 2½ ft. wide by 4 in. deep. The inside of the box is partitioned off in widths depending upon the size of the core. From 50 to 80 ft. of core can thus be carried in each box, the amount being governed by core size. The core is then "logged" or classified according to grade and rock type, by visual examination. Splitting limits being indicated to the sampling department, the core is then split into two halves for assay purposes, one half being sent to the assay office for testing, the other half being retained in the box for check assays and reference. Only those portions of the core showing ore values by visual examination are split for assay purposes; the remaining portion is retained and later "skeletonised."

"Skeletonising" consists in reducing the core to a minimum. That is, a representative sample of each ten feet of core is kept, the remainder of the core being thrown aside. Breaks in the country rock are recorded, also faulting, folding, jointing, and any other data worth recording. Specimens of different rock types are retained when and where necessary and footages marked where found. Small blocks of wood are used to record footages between the various representative samples retained. Thus 500 ft. of drill-core can be reduced down to approximately 50 ft. efficiently and cheaply. Later on, samples that have been split for assay purposes can also be "skeletonised" for future reference.

This method of keeping drill-core records has a lot to recommend it and is very useful for small mines and operators who require a quick, efficient and cheap method of keeping drill-core records.

J. L. JOLLY,
Inspector of Mines
Rockhampton, Queensland, Australia

Nuggets on Mountain Tops

The Editor:

IN THE November *E.&M.J.* is an article, "Western Mining Needs New Prospecting Methods," by J. H. Farrell. He says mining exploration has declined in the West because the costs and problems involved are too great for individual prospecting.

In the following is described what might prove to be a new source of placer gold, one an individual can prospect for and work.

On the edge of the desert 10 miles from the Congress mine, in Arizona, is a high granite peak. It is called Rich Hill. In early days at least $100,000 in gold nuggets was picked from the surface of the ground on top of this peak. To most people this is rather mysterious. They wonder why placer gold, which is normally found in creek and river beds, should be found on top of a mountain peak. Here is my explanation of this unusual occurrence:

In the Southwest, in comparatively recent geologic times, there was an extensive ancient river system, just as extensive as the present river system. From some cause the channels of this ancient river system filled or nearly filled with gravel. Then came great lava flows. For the most part they flowed over the top of this gravel. Then came a period of great faulting, block faulting. Today, due to this faulting, one can find great blocks of lava below present stream beds, one can find great beds of ancient river gravel far above the present stream beds, and in places one can see the bottom of old river beds above present creek beds. I believe the top of Rich Hill was at one time the bottom of an ancient river or creek bed. Its gravel, having been completely eroded away, exposed the gold on bedrock. It seems to me there must be many other places where faulting and erosion have exposed or nearly exposed the bottom in places of many of these ancient river beds. The prospecting and working of these would not be too much of a job for an individual.

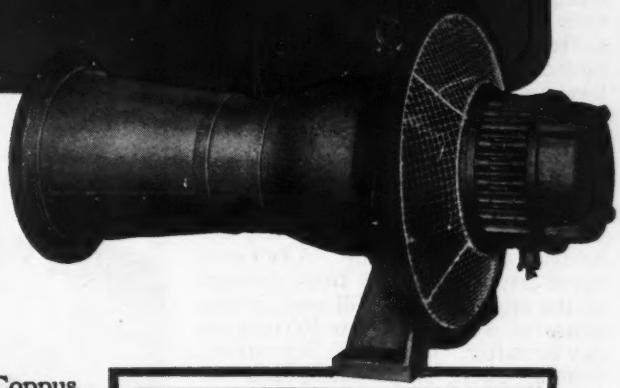
It may be that some of our lost placer mines are of that class. Those looking for them wouldn't think of looking on top of a mountain peak.

Prescott, Ariz. WM. CROCKER

COPPUS VENTAIR

How to Pick the Blower To Get the Most Air per H. P.

COPPUS VANO

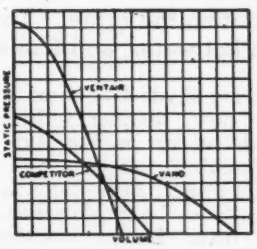


What's the length of your ventilating line?

If your line is short, if pressure is medium — select the Coppus VANO, a propeller-type fan.

If your line is long, if pressure is high — select the Coppus VENTAIR, a centrifugal-type fan.

Only from Coppus do you obtain a choice of both types of mine ventilating fans. One or the other will give you *more air* for a given power consumption — 30 to 100% more air! — than any other type of blower.* The chart illustrates this.



This chart shows VANO outperforming VENTAIR over the shorter distances; VENTAIR delivering more efficiently over the greater pipe lengths. One or the other Coppus fan is always more efficient than the average all-purpose fan.

*A Coppus 2 H. P. blower has been known to outperform a competitive 5 H. P. under identical conditions.

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REGIONAL NEWS

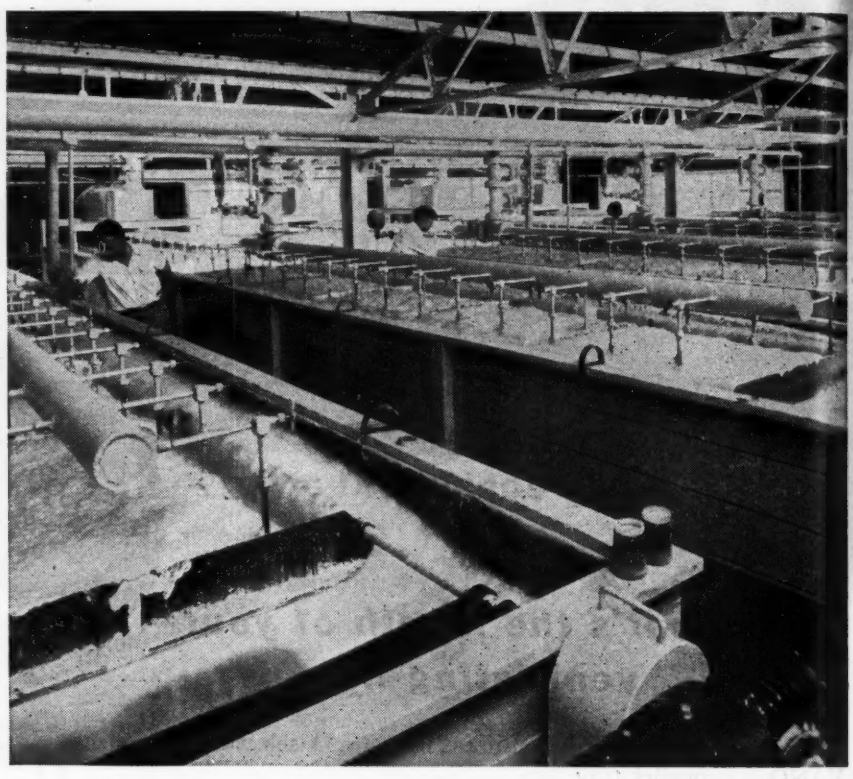
NEVADA

Locomotives and loaders added to underground equipment at Nevada-Massachusetts property

★Underground equipment of tungsten mines of the Nevada-Massachusetts Co. at Tungsten, Pershing County, has been further mechanized by addition of three electric locomotives and mucking machines. Production has come from three shafts, one over 1,200 ft. deep, and the reserve has been largely increased by recent development to the 900-ft. level in the Sutton workings. Ore is trammed to a 700-ton coarse-crushing unit at the site of the 260-ton concentrator that was destroyed by fire in November 1943, and crushed ore is trucked about 1,000 ft. to bins at the 1,000-ton tailing flotation plant, remodeled to treat mine ore. A belt conveyor later will replace truck delivery of the crushed ore. Mill feed, it was indicated, will approximate 400 tons per day hereafter. Charles H. Segerstrom, Sonora, Calif., is president, and W. Glenn Emminger is manager at Tungsten. The latter succeeded Ott F. Heizer, lately retired, who in 25 years built the enterprise from a relatively small project to one of the largest U. S. producers of high-grade scheelite concentrate.

★Intense cold at high altitudes has compelled suspension of several deep-drilling projects in the State, including those of the U. S. Smelting, Refining & Mining Co. on its Mountain View zinc property, west of Eureka, where the manager W. Frank Wathall will resume diamond drilling when the weather moderates; the New Verde Mining Co., a Newmont subsidiary, north of Goldfield, and the Mountain City Consolidated Copper Co., in the Cope district, northern Elko County. The last-named is preparing to drill with lighter equipment from the station at the inside shaft in its main tunnel and will resume deeper drilling from the surface in the spring in preparation for sinking a deep main shaft.

★Tonopah Divide Mining Co. reports that its gold-silver property at Divide, Esmeralda County, worked in late years only by lessees, in 1944 produced 1,195 tons of ore yielding 800 oz. gold and 3,040 oz. silver, returning gross $27,492, or about $23 per ton. Charges of $15,351 left a net of $12.85 per ton and $2,257.96 received in royalties. Cost price of securities owned is $47,392.36 and cash in banks $38,541.87 at year's end. The directors have taken an option on the Gaston gold mine, in Nevada County, Calif. Nominated for directors, to be named at a meeting March 7, are Clyde D. Souter, a Reno attorney now president; Eldon L. Cleveland, officer in the Army Air Corps; Joseph E. Snelson, San Francisco hotel owner; Bert Riddick, Reno hotel man, and Tracy Markwell, Reno business man. Lessees continue to ship a moderate volume of ore from a shoot opened on the 300-ft. level of the 1,450-ft. main shaft.



Pneumatic flotation cells in new lithium plant of American Potash & Chemical Corporation at Trona, Calif., where lithium in Searles Lake brine is now recovered as lithium-sodium phosphate (see article, p. 93), serve to float this double salt, which is formed in evaporating and concentrating the brine. The salt is then thickened, purified by leaching with hot water, and filtered.

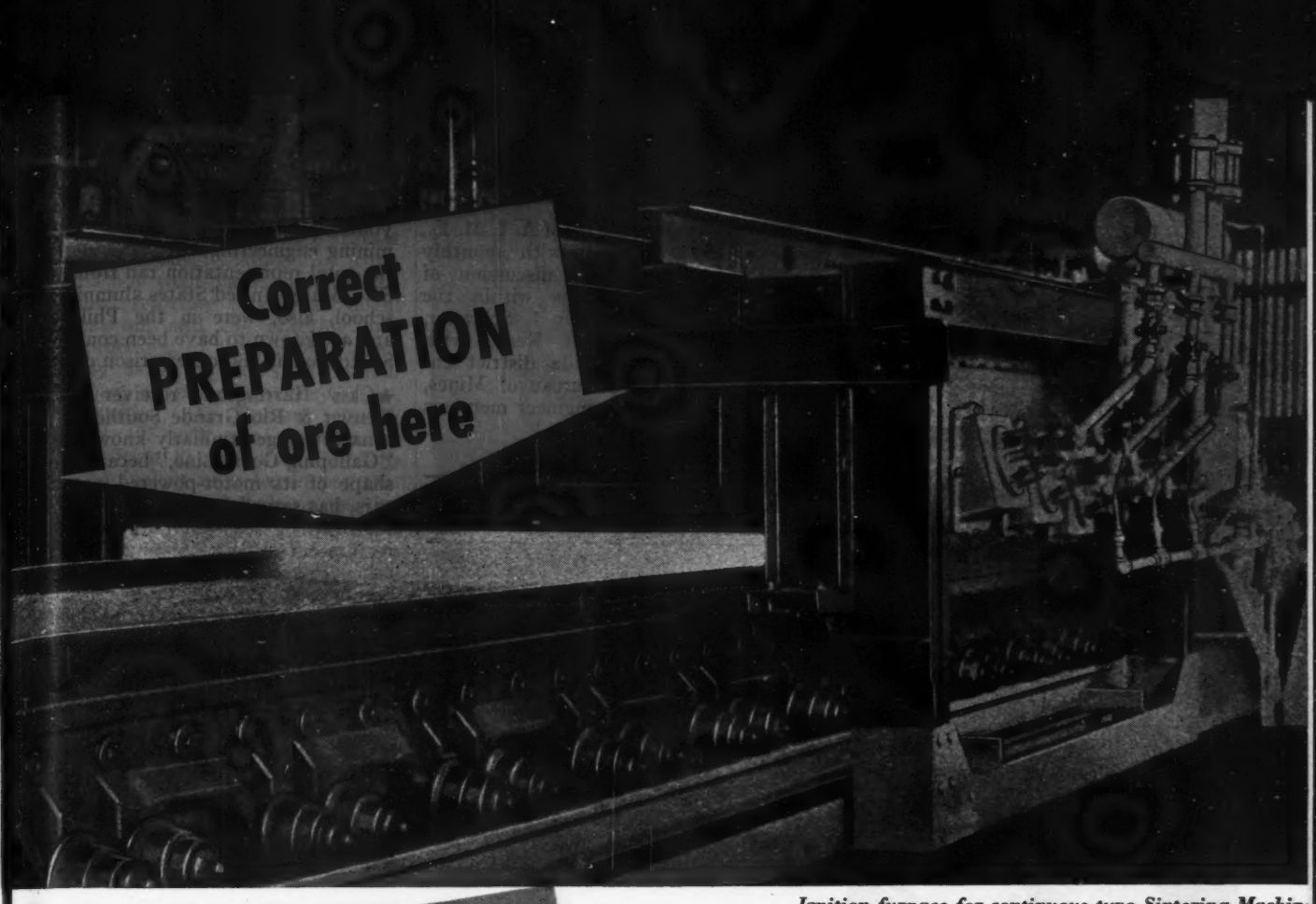
★Early completion of a 75-ton scheelite concentrator is in prospect at the Valley View tungsten mine, in the Potosi district, 5 miles south of the Getchell gold mine and near the Riley mine, where a 250-ton tungsten plant is nearly ready for operation. Purchased recently by Don Burgner, contractor of Reno, from Frank Saunders, of Winnemucca, the Valley View had been worked during the past year by the Harold's Club Mining Co. and contributed several thousand tons of scheelite to the Metals Reserve stockpile near the Getchell tungsten plant.

★Remodeling of buildings at the Basic Magnesium, Inc., plant in Clark County, warehouses and structures not connected with magnesium metal production, has been started by the Rheems Manufacturing Co., which has been awarded contracts for fabrication of mortar shell and rocket casings for the Army and Navy and has just announced a third contract for an unspecified war product. Estimates of employment needs, placed earlier at 700 to 800 men, have been increased to 1,000, a Rheems executive stated.

★The tungsten mine and 100-ton plant of the M. G. L. Mining Corp. in southwestern Pershing County, in the Nightingale district, have been closed because of manpower shortage after substantial output of good-grade concentrate. The company, headed by Arthur Letts, Jr., of Los Angeles, leased the property from State Senator R. H. Cowles, of Reno, and has had a remarkable turnover of workers and of managers, foremen and mill employees.

★Only one fatal mine accident in Nevada in 1944 is recorded in the report of Matt Murphy, State Inspector of Mines, who says all mine accidents were less than in any other Western State, despite the necessity for employment of inexperienced men.

★Organization of the Northwestern



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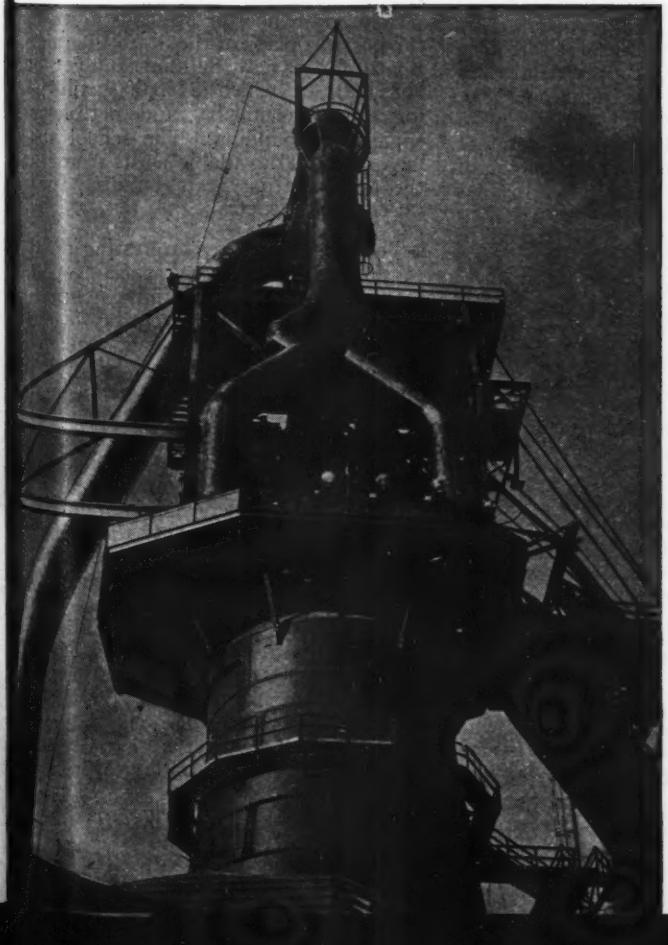

PROPER treatment of raw materials is becoming one of the most effective means of reducing the cost per ton of iron and steel.

While your postwar plans may call for replacement, modernization or repair of existing blast furnaces and steel plants, you should not overlook the fact that opportunities for reducing costs *begin* with preparation of raw materials.

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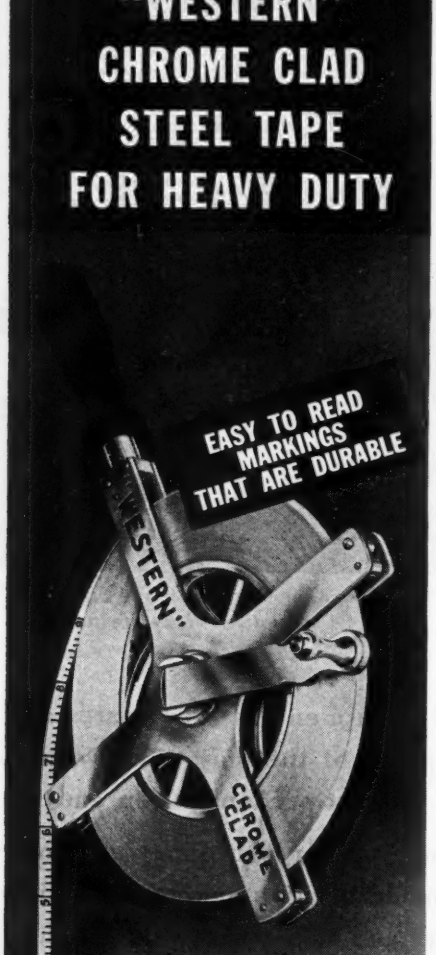

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TAPES . RULES . PRECISION TOOLS

Nevada (*continued*)

Branch, Nevada Section of A. I. M. E., was effected recently with monthly meetings in Reno for discussion of the industry's problems within the state. Chairman is Eric J. Schrader, consulting engineer of Reno, with Glenn L. Allen, Nevada district engineer for the U.S. Bureau of Mines, secretary. Some 60 engineer members were enrolled.

COLORADO

Plan to thwart Ickes' proposal to collect royalties on Leadville tunnel ore

★Leadville mining operators have always resented Secretary of the Interior Harold L. Ickes' plan to charge them royalties on ore made accessible by the 17,000-ft. drainage tunnel now being driven to unwater the deeper workings of the famous old mine field, and are taking steps to avoid it. In the Colorado Assembly—it has already passed the Senate—is a bill which would change the provisions of the Colorado Mine Drainage Act of 1935 in two respects—i.e., that mine owners benefited by a drainage project should not have to pay for it if the project were financed in whole or in part by the United States, nor on undeveloped ground which was not proved territory before the waters flooded it, or is not in actual production at the time of the drainage project.

★When Congress appropriated $1,400,000 two years ago for the tunnel, its intent, according to mine operators and Colorado's entire Congressional delegation, was to finance the project to make badly needed copper, lead, and zinc available for war, and not as a reimbursable project for the benefit of mine owners. But Mr. Ickes thought otherwise. He construed an opinion of the Comptroller-General to mean that he had to attempt to recover the government expenditure, or part of it, from mine operators. His attorneys found the legal ground in provisions of the Colorado Mine Drainage Act of 1935, setting up means of collecting from operators for mine drainage projects in general. Now the exemption is contemplated to make the drainage tunnel what operators contend Congress always intended—one at the expense of the government to provide minerals for war. What the lawyers will say about the legality of an exemption act enacted long after contracts are signed, royalties set, and the work started, isn't yet known.

★Colorado School of Mines had a special interest in the liberation of prisoners of the Japanese at Santo Tomas and Bilibid, in Manila, because of the large number of graduates who were in the Islands when the Japanese took over. This was in part because in prewar years the Colorado school had in each class several Philippine youths here from the Islands to study mining engineering. In a normal year the total representation ran from 40 to 50. Many United States alumni of the school, also, were in the Philippines and are known to have been confined in Santo Tomas and other prison camps.

★Cass Harrington, receiver of the Denver & Rio Grande Southern R.R., a narrow-gage familiarly known as the "Galloping Goose Line," because of the shape of its motor-powered passenger cars, has served formal notice that the road cannot keep going any longer on its present scale of revenue. He has asked the federal court in Denver for permission to abandon operation entirely. A hearing was to be held in late February, although a decision may not be reached for sometime thereafter. Meanwhile, Colorado's Congressional delegation was busy seeking an RFC or other form of United States loan for continued operation. The line operates from Ridgway via Telluride, Rico, Dolores, and Mancos to Durango, where it connects with main line of the D. & R.G.W., by which it is owned, though operated separately. The first three towns named are mining localities producing strategic minerals, and they will be up against it for transportation of machines or materials too heavy to move by truck, if rail operation ceases. Mr. Harrington said that because of decreased shipment of both mine and farm products, "It is apparent it will be impossible to perform even the most cutback maintenance and survive the coming slack season without running entirely out of cash." He said carloadings in December, 1944, were down 286 from their number in December, 1943.

★Colorado School of Mines is down in the postwar plans of the State Planning Board for a new building budget of $685,000, of which $428,000 will be for a new chemistry and petroleum engineering building. The school will have $606,000 available as its share of the accumulating State building fund raised from a special State tax.

★The most definitely interesting point to mining men in the special report made to the Colorado Mining Association on oil-shale development in western Colorado, by A. J. Kraemer, chief of the oil section of the Bureau of Mines, and H. P. Rue, supervising engineer of the Bureau of Mines Petroleum and Oil Shale Experiment Station at Laramie, Wyo., is that the shale will definitely be produced by conventional mining methods, and underground mining at that. Oil shales constitute the surface of the ground over several hundred square miles, with vertical depths up to 1,500 ft. Nevertheless, it has been determined at the field office established at Rifle, Colo., by Boyd Guthrie, of the Bureau, that the most feasible project is to go beneath some 200 to 500 ft. of leaner shale overburden, and mine a 69-ft. vertical shale series that is comparatively rich. The mining operation

will be of a size to provide definite experience as to costs in commercial shale mining, as it will produce at least 1,000 tons daily. Likewise of commercial, not pilot-plant, size will be the allied retorting process to distill the shale-oil, and the cracking and other processes to turn it into commercially usable products. In small, preliminary experiments at the Golden, Colo., station, the Bureau recently extracted 495 gallons of kerogen, or shale-oil, from 12 tons of shale. This is the equivalent of a barrel per ton. Therefore, even if all shale proves this rich, the Bureau's task is to produce a ton of shale, distill and extract its products and finish them up in commercial form, all within the cost limits imposed by the present cost of crude oil.

★Treasury Tunnel mill of the Idarado Mining Co., near Ouray, was given a test run early in January, and will be brought up to its 300-ton daily capacity as fast as possible, according to C. W. Plumb, general manager. The ore will be separated into three concentrates—lead, zinc, and copper—yielding about 4 tons of lead concentrates, 8 of zinc, and 5 of copper from each 100 tons of ore milled.

★Colorado Fluorspar Mines, Inc., a subsidiary of Sonoma Quicksilver Mines, Inc., San Francisco, Calif., H. D. Tudor, president, has acquired the property of Colorado Fluorspar Corp., of Salida. Company engineers examining the mine found about 200,000 tons of ore blocked out. Most of it is high grade, assaying about 55 percent fluorspar. The purchase price was $300,000, with a down payment of $50,000 and the remainder to be paid in installments out of earnings.

★Chaffee County Fluorspar Co. put its new flotation mill into production early in January. This is the fourth mill built in Browns Canyon near Salida, adding to Colorado's prominence as a fluorspar producer. At the annual meeting in late January, N. J. Nicholson, Denver, was elected president, succeeding Sam Sclavenitis. Axel Johnson is mill superintendent, and Hugo Bryan is in charge of the mine.

★The Nonferrous Metals Commission of the NWLB made two decisions in February affecting Colorado mines. It denied the request of UMW District 50 for general wage increases for 45 employees of the Colorado Fluorspar Co., Salida, but left the way open for reclassification of job titles and rates if the need for this could be demonstrated. The company was ordered to comply with a regulation on overtime compensation by paying double time for the seventh consecutive day of work, and time and one-half for holidays, retroactive to Oct. 1, 1942.

A dispute between Climax Molybdenum Co., Climax, and the Mine, Mill and Smelter Workers, CIO, relative to seniority and grievances, was settled by ordering five new clauses incorporated in the contract between them. Voluntary maintenance of mem-

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A typical metal mine installation showing Jeffrey Locomotives handling iron ore. These locomotives have the stamina to stand up under rough usage, and are designed to protect the equipment from water dripping from the roof and wet muck over the track.

AERODYNE FANS

A Jeffrey Aerodyne fan installation at a zinc mine in Colorado. Adequate air supply at the working face is very essential to maintain top production. This propeller type fan (patented) has adjustable blades—features high capacity—low speed—pressures up to 10 inches—and maintains static efficiencies well over 80% on a wide range of duties.

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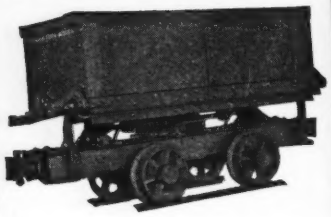

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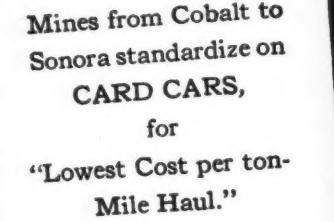


C.S. Card Iron Works Co.
Denver, Colorado

Colorado *(continued)*

bership, with a 15-day escape period, was ordered, but the union's request for a closed shop was denied. The union's demand for general wage increases to bring rates up to those in the Coeur d'Alene, Idaho, mining area, for a guaranteed annual wage and for sick leave were denied.

In both of the above cases, following the policy established by the NWLB, the Commission ordered the companies to grant extra pay for night work: 4¢ an hour on second shifts, 6¢ an hour on intermediate shifts in mines, and 8¢ an hour on third shifts.

UTAH

Utah mine employment at low ebb in face of urgent demand for more metal by Army-Navy

★From a high of 2,290 workers employed in gold, silver, lead, and zinc mining in Utah in February 1942, employment dropped to a low of 1,901 in June 1944, the last month of a compilation by the Utah Department of Employment Security of the State Industrial Commission. The State's copper-mining industry was the most stable of any branch of mining, with an average employment of between 5,000 and 6,000 men between 1940 and 1944. Miscellaneous metals, such as mercury, manganese, chromium, molybdenum, tungsten, and vanadium, averaged 367 workers and dropped to 93 workers as of June 1944.

★During 1942–1943, Utah's copper-producing industry paid out more than $26,000,000 in wages alone, the average monthly individual pay being $196.50. Gold, silver, lead, and zinc production, with a monthly average of 2,511 employes, paid out more than $10,500,000 in 1942 and 1943. The average monthly individual wage was $175.

★A public hearing scheduled to have been conducted by Senators Pat McCarran and Abe Murdock beginning Feb. 5 in Salt Lake City, relative to withdrawal of 3,000,000 acres of public lands in southeastern Utah, was postponed. All but 200,000 acres of land containing potash and magnesium was restored to public domain recently.

★Army supervision of the Bingham & Garfield railway, vital link in operations of the Utah Copper Co., was begun Jan. 25, when 37 members of the Brotherhood of Locomotive Firemen and Enginemen went on strike for several hours. Members of the ninth transportation zone, headed by Col. W. H. Hastings, took over under a directive signed by President Roosevelt. The brotherhood had contended that two men should be employed in the cab of each of three electric locomotives used in switching operations at Bingham, Magna, and Arthur yards. The dispute was placed in the hands of a special presidential board which conducted a public hearing in Salt Lake City last November and visited the switching operations to see them at first hand. The board ruled against the brotherhood's claim. C. H. Keenen, Cleveland, Ohio, vice president of the brotherhood, and A. J. Chipman, general chairman for this area, came to Salt Lake City. They said the ruling of the presidential board was not definite, and, even if it were, the brotherhood was not legally bound to accept that ruling. Mr. Keenen offered to arbitrate the matter now. Company officials declined arbitration on the ground that the special board decided the issue. Meantime, normal operations continue with only one man in the cab of the switching locomotives. An engine foreman and two brakemen also are employed on each switching crew. One army officer remains in the office of C. C. Parsons, president of the railway, Salt Lake City, and another officer is in the office of F. O. Raymond, vice president and general manager, at Magna.

★Announcement has been made that George B. Robbe, Bingham, Utah, has donated $5,000 to the Michigan College of Mining and Technology, Houghton, Mich., alumni foundation for scholarships, in honor of his professors, the late G. A. Koenig, A. E. Seaman, and F. W. Sperr.

★Utah Copper Co. employees have been given the Army and Navy "E" award for the fourth consecutive time for excellence in production of copper, D. D. Moffat, president and general manager, was notified Feb. 7 by Robert B. Patterson, Under Secretary of War. The new award is for the six-month period ended Jan. 13, 1945. The company is the only Utah group to receive the "E" award for the fourth consecutive time.

★Silver King Coalition Mines Co. suffered a net loss of $20,697.69 after all taxes and depreciation, but before depletion, equal to 1.7¢. per share on 1,220,467 shares of $5 per value common stock outstanding, for the quarter ended Dec. 31, 1944. Net profit for the year ended Dec. 31, 1944, was $6,870.32, or 6¢. per outstanding share.

★Park Utah Consolidated Mines Co. filed suit Jan. 23 in the federal district court against Summit and Wasatch counties, asking for money paid under protest because federal premium payments had been included in figuring taxable values. The company sought refund of $13,622.97 from Summit County and $11,229.87 from Wasatch County.

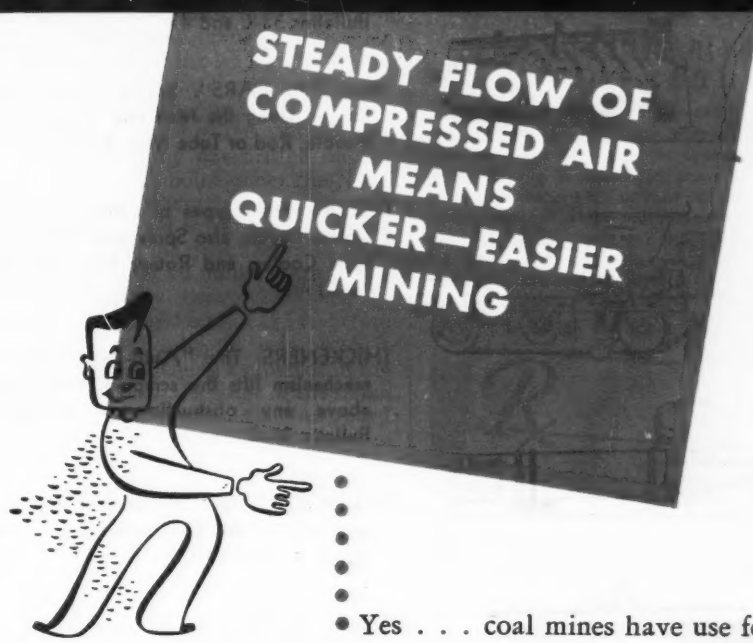
★Six Utah mining companies filed a suit against the State Tax Commission on Feb. 7, seeking to recover mine occupation taxes totaling $11,138 paid under protest for 1944, plus $144.89 interest. This and other similar suits follow a ruling by Federal District Judge Tillman D. Johnson that federal premium payments were not to be counted as profits. The Feb. 7 suit filed in the

third district court charges that the State tax commission exceeded its authority by including federal premium payments in calculating the mine occupation tax (1 percent of gross proceeds as fixed by statute). Companies which filed suit and amounts sought are: U.S. Smelting, Refining & Mining Co., $1,235.68 and $17.06 interest; Montana-Bingham Consolidated Mining Co., $329.50 and $4.55 interest; Chief Consolidated Mining Co., $4,922.39 and $69.73 interest; Colorado Consolidated Mines Co., $137.58 and $1.88; Tintic Standard Mining Co., $4,404.94 and $60.20, and Eureka Lilly Consolidated Mining Co., $107.92 and $1.47.

★Current shortages of both lead and zinc and consequent need for all available imports of these metals are in contrast to postwar need for tariff protection for both domestic metal producing industries, Felix E. Wormser, secretary of Lead Industries Association, and Ernest Gent, secretary, American Zinc Institute, both of New York City, agreed Jan. 29 in Salt Lake City. Mr. Wormser was optimistic concerning the postwar future of lead because of the great backlog of demand for civilian requirements, but said tariff protection would be necessary. Mr. Gent said the nation is fortunate in having reserve stocks of zinc, but if present consumption estimates are realized, the nation will need to dig into stockpiles, even if present production is maintained.

★Utah Copper Co. late in January received messages from high officials of the Army and the Navy relative to urgent need for high production of copper. Lt. Gen. W. D. Styer, Army service forces commander, sent the following radio message: "General Eisenhower's recent appeal for immediate increases in shipments of ammunition, wire and other vital war items needed for a crushing blow against Germany calls for sharp boosts in the production of copper. Where copper output was once adequate, supplies are now falling far short of demand. Some of our most critical war plants have been forced to curtail production of urgent military items because of the shortages of copper. You men and women of the copper industry have done an outstanding job thus far, but the growing intensity of our operations and the tremendous losses of equipment in battle require even greater effort in the days and weeks ahead."

★In a letter to D. D. Moffat, president and general manager of Utah Copper Company, Vice Admiral S. M. Robinson said all estimates of the copper situation indicate that planned increases in munitions programs will create a demand for copper in excess of supply. The task of the copper industry in continuing to supply sufficient quantities of the red metal will be increased because of fewer available workers. The admiral suggested that each employee can help best by staying at his job and doing a little more work each day and by serving as a committee of one to recruit additional help. "The recent good news



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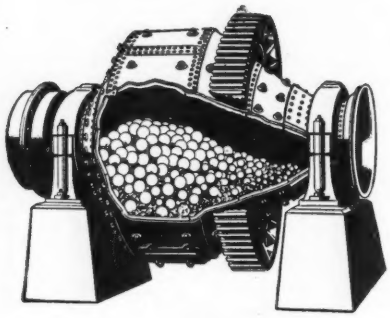
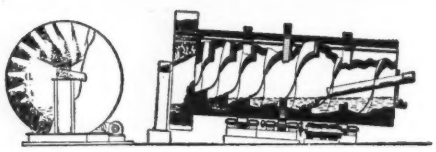


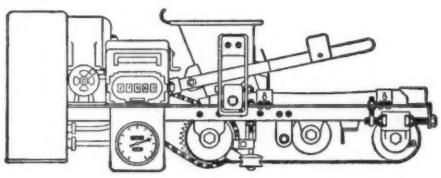
MILLS: Conical Ball and Pebble Mills, also Rod, Tube, Compartment, Batch and "Thermomills." Bulletin 13-D.

CLASSIFIERS: Reversed current Air Classifiers for classification of dry materials; Counter-current and Hydro for wet classification. Bulletin 39-A.



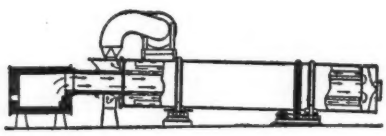
FEEDERS: Constant Weight, Weight Recording, Disc and Volumetric types. Bulletins 33-C and 43.

"ELECTRIC EARS": Sound control units for regulating the feed rate to any Ball, Pebble, Rod or Tube Mill. Bulletin 42.

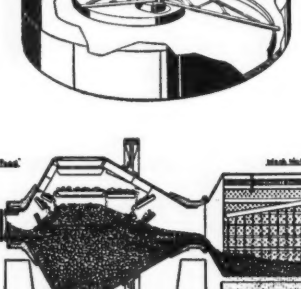


DRYERS: Nine types of "Ruggles-Coles" Rotary Dryers, also Spray and Submerged type Coolers and Rotary Kilns. Bulletin 16-C.

THICKENERS: The "Auto-Raise" driving mechanism lifts the scraping mechanisms above any obstruction or overload. Bulletin 31-C.

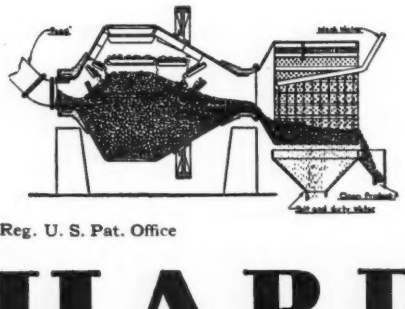


AGITATORS: Pulp circulated through torque tube to the distributing arms above liquid. Bulletin 31-C.



SAND FILTERS: For final clarification of liquids. Sand bed kept active by spiral scrapers. Bulletin 30-A.

PUMPS: Diaphragm Pumps including pressure type. Bulletin 32.



SCRUBBERS: Classification action of the cones holds back clay ball until they are disintegrated. Bulletin 37.

ROTARY CONVEYORS: For handling hot, abrasives, dusty materials as calcines, cement clinker and ashes. Bulletin 44.

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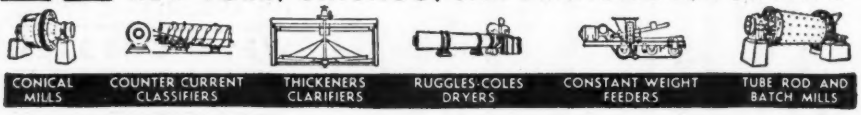

CONICAL MILLS | COUNTER CURRENT CLASSIFIERS | THICKENERS CLARIFIERS | RUGGLES-COLES DRYERS | CONSTANT WEIGHT FEEDERS | TUBE ROD AND BATCH MILLS

Utah (*continued*)

from the fleet was made possible by production programs that were planned many months ago," he continued. "Your assurance of maximum copper production is needed at this time so that the Navy will be able to bring you better news in the future."

IDAHO

Pine Creek district has four zinc-lead producers—Sidney to build 250-ton milling plant

★Among the interesting prospecting developments in the Coeur d'Alene district today are the deep operations under way at the Silver Dollar and Lucky Friday properties, several miles apart in the west and east ends of the district. Both mines have high-grade oreshoots, from which substantial shipments have been made.

★At the Silver Dollar the oreshoot persisted down to about the 1,600 level, where the vein appeared to be badly broken up, but contains some sprinkling of ore the full length of Silver Dollar ground. The same disturbed conditions persisted to the 1,800 level. The company is preparing to sink from the 1,800 level an additional depth of 600 ft., which will place the work on the same level as the 2,300 level in the Sunshine mine workings, which marks the top of the rich ore discovery in the Chester vein. Silver Dollar has already cut a station on the 1,800 level and prepared the necessary raise and skip-pocket work to accommodate the new shaft development. The company's new hoisting equipment will be purchased from the Coeur d'Alene Hardware & Foundry Co., which concern is also furnishing the Lucky Friday hoist.

★The Lucky Friday company is preparing deeper shaft operations from the 800 level. This company has no objective in view except to obtain additional depth. The company has been prospecting the vein at 200-ft. intervals, shipping enough ore from each level to pay all expenses and sink an additional 200 ft. At 800 ft., however, the work had reached the limit of the capacity of the hoisting equipment, and it was found necessary to install a larger hoist. This equipment is now installed and ready for operation. The company has about 2,000 tons of ore in stockpile ready for milling.

★The Silver Syndicate property has diamond-drilled the Chester vein at points up to 2,500 ft. west of the area, where Sunshine, Polaris, Silver Syndicate, Silver Dollar, and Lincoln companies are mining on the 3,100 level of the mine. Silver Syndicate's drilling of the vein further west and on the 2,700 level indicated a 20-ft. wide mineralized vein. Officials of the company report that the drill hole would not core through the vein, but about 4 ft. of the

drill sludge assayed 9.5 oz. in silver and 3.5 percent lead. Silver Syndicate is now engaged in driving a crosscut 245 ft. to crosscut this vein on the deep level.

★The Pine Creek district of the Coeur d'Alenes, several miles south of the Bunker Hill at Kellogg, is rapidly coming to the front as a zinc-lead producer. It is estimated that about 500 tons of zinc-lead concentrates per day are coming out of the district from four major producing mines, the Sidney, Highland-Surprise, Douglas, and Spokane-Idaho. U. S. Bureau of Mines diamond-drill operations in the district during the past two years have developed major orebodies, one of which is at the Sidney property, where deeper drift development has proved the diamond-drill forecast. Sidney officials now report this orebody developed on the No. 5 mine level for a length of 600 ft., during which the ore has averaged from 5 to 23 ft. in width. The company is operating a 50-ton mill at the mine, the mill feed averaging 7.9 percent lead and 10.7 percent zinc. The lead concentrate averages 68.5 percent lead and about 25 oz. silver per ton, and the zinc concentrate averages 54.6 percent zinc and 5.6 percent lead.

★The Nevada-Stewart property, adjoining the Sidney on the south and east, was also drilled by the U. S. Bureau of Mines, and the company reports that major orebodies were located. The Nevada-Stewart owners have since purchased control of the Highland-Surprise mine, still further southeast on the strike of the mineralized zone, and are making preparations to develop both properties through one operating shaft. The Highland-Surprise property is equipped with a modern 250-ton flotation mill and has three veins opened to a depth of 500 ft. This operation recently produced a dividend of 12½¢ per share, totaling $123,704.

★The Douglas mine, further to the southeast on a parallel mineral zone, was operated under lease during the first World War for its zinc ores, by the Anaconda Copper Mining Co., of Butte. This company hand-sorted the ore and shipped it to the Anaconda smelter at Anaconda, Mont. Royalties paid the Douglas company resulted in dividends totaling $38,407, which were the first dividends paid by any mine in the Pine Creek area. (The Sidney company property was also under lease later during the war and paid royalty dividends of $173,685.) The Douglas property is now under lease to the Small Leasing Co., of Wallace, and has been equipped with a 150-ton flotation mill. Production was started from the old workings, but recently the company has unwatered a shaft sunk by the Anaconda company 200 ft. below the surface tunnel level and has developed substantially improved orebodies. The company has also diamond-drilled to greater depth below the shaft level and reports improvement in the lead content of the ore.

★Still farther southeast on this belt the Spokane-Idaho company has reopened the old Constitution mine, a steady shipper during the first World War, and has equipped the property with a 100-ton flotation plant. The property had been operated on a complex ore that was very difficult of separation, so a composite zinc-lead concentrate was produced. This practice has been continued by the present company. The company's main shaft has recently been extended down to the 900 level, where the vein shows a 6-ft. width of ore containing increased lead content.

★The Daylight Lease Co., of which Harry P. Pearson is general manager, has made a trial shipment of 1,630 tons of ore from a recent discovery in the Nipsic vein of the old Interstate-Callahan Co., which the Daylight company holds under a ten-year lease. The ore was treated at the Galena mill, in Wallace, and produced one carload of concentrates which gave net smelter returns of 72 percent lead and 17.5 oz. of silver per ton, and one car of zinc concentrates averaging 55.5 percent zinc. Since locating the Nipsic orebody the company has drifted on the vein easterly to a point under the No. 4 Nipsic tunnel, where a connection was made with the old workings by a 50-ft. raise, and both the drift and raise show about three feet of milling ore. The leasing company drove 2,000 ft. of crosscut tunnel and a raise 435 ft. before encountering the Nipsic vein, and is now engaged in driving a crosscut in the raise 135 ft. below the scene of the strike in an effort to determine the downward extension of the orebody.

★Bunker Hill & Sullivan Mining & Concentrating Co. has declared a dividend of 12½¢ a share, or a total of $163,500. The dividend is payable March 3 to stock of record Feb. 16, and brings the Bunker Hill dividend record to a grand total of $59,404,741. Last year the company paid $654,000 and for 1943, $1,308,000. The company is making steady and permanent improvements in preparation for increased output as soon as manpower is available. Among other recent developments is a new unit for the recovery of cadmium from flue dust. The company is also installing new hoisting equipment in the Bunker Hill mine at a cost of over $550,000, which will eventually carry the mine workings to a depth of 6,000 ft., or 1,600 ft. below sea level. Production of mine tonnage during 1944 was reduced about 40 percent on account of labor shortage, but mill production has been maintained about normal by utilizing a sink-and-float product from old tailings dumps.

★The Bradley Mining Co., which is already producing 50 percent of the tungsten mineral mined in the United States from its Yellow Pine mine, at Stibnite, Valley County, Idaho, has purchased under lease and bond the Ima tungsten mine, at Patterson, in Lemhi County, Idaho, and has placed J. A. Mecia, formerly manager of the Yellow Pine, in charge of the Ima operation. The Ima property has been developed

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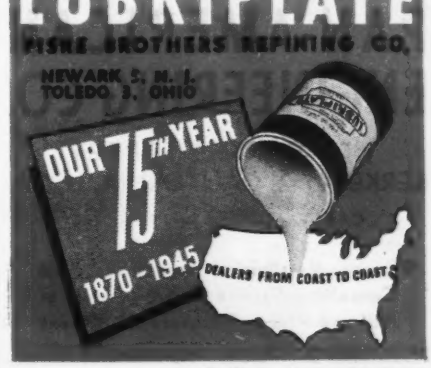

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Idaho (*continued*)

by the Ima Mines Corp., of which Ben R. Tillery, of Twin Falls, Idaho, is president. This company equipped the property with a modern flotation mill which produced lead and copper concentrates in addition to the tungsten product, and was the largest producer of tungsten in the U. S. until the discovery of the Yellow Pine mine. The Bradley company plans to enlarge the production capacity of the plant. The Ima deposit has been extensively diamond-drilled by the U. S. Bureau of Mines and has been equipped with modern dwelling houses by the RFC. The General Electric Co. also owns extensive holdings on potential tungsten mining property in the same district, but is not in production.

★The June Day property, near Hailey, Idaho, is being developed by Frank R. Plugoff, of Hailey, and C. E. Carber, of Pasadena, Calif., who state that shipments of ore will soon be made. The same management is also developing the Camas Trust and Baltimore Trust claims and other properties in the same district.

★In a preliminary report covering operations at the Sunshine mine for the last three months of 1944 the manager, R. D. Leisk, states that all available labor is being concentrated on lead-silver ores from the Silver Syndicate-Chester vein system. This orebody has been blocked out on the 2,300, 2,500, 2,900, and 3,100 levels, and has recently been found on the 3,700 level, where drifting on a full face of ore is now in progress. During 1944 Sunshine mined from this vein 91,956 tons of ore, from which was received net smelter returns totaling $3,569,702. Profits are participated in by four companies, Sunshine, Polaris, Silver Syndicate, and Silver Dollar, depending on location of the ore mined. The net returns included 3,298 tons of ore from the Sunshine vein, which was mined during the first quarter of the year. No production has been made from the Sunshine mine proper since that time for the reason that the ore does not carry as much lead as the Chester vein. Segregated, the metals recovered from the mine during the last quarter totaled 4,137,163 oz silver; 11,374,495 lb. lead, and 913,429 lb. copper.

★Hecla Mining Co. has declared a dividend for the first quarter of 1945, amounting to 25c. a share, or a total of $250,000, and is payable March 15 to stock of record Feb. 15. This payment will bring the Hecla company's dividend record to a grand total of $28,405,000. The company owns a half interest in the Sullivan Mining Co., owners of the Star zinc-lead mine, between Burke and Mullan, and the Sullivan zinc plant at Kellogg. Other mining interests of the company include the Hecla tailings plant at Osburn, mining interests in British Columbia, Colorado, and California, and control ownership of the Polaris Mining Co., now operating the Chester vein in the Coeur d'Alene district in half net profits ownership with Sunshine.

ARIZONA

Renewed activity in Chloride area—Keystone mill being prepared for custom milling

★The Squaw Peak mine, about 10 miles south of Camp Verde at an elevation of 4,200 ft., is being operated by the owning company, of which Edison Thacker is president. The ore contains copper mineral carrying gold and silver, and molybdenite. Separation is made by selective flotation, yielding copper concentrates of 24 percent copper, with gold and silver, and molybdenite concentrates of 93 percent MoS_2. Copper concentrates are shipped to the Phelps Dodge smelter at Clarkdale and molybdenum concentrates have been shipped to Metals Reserve Co. The mine supplies ample water for the mill, which was installed as a pilot plant to handle about 25 tons a day. Gasoline and diesel power are used for the mill and mine, respectively.

★The Juno mine in the Chloride area of the Cerbat range, about one mile north of the town of Chloride, is now in operation under the direction of J. H. Beauchamp. The property had been idle from 1908 until two years ago, when it was taken over by Beauchamp. For several months past the mine has been shipping monthly from 200 to 250 tons of lead-zinc ore to the smelter at Midvale, Utah. Seven men are employed.

★The Keystone mill, in Mineral Park, is being prepared for custom milling and was expected to be in operation in late February or early March. Equipped to handle complex ores, the plant will produce lead and zinc concentrates by selective flotation. Its operation is expected to be of great benefit to numerous small mines in the surrounding area which now find it unprofitable to ship their complex ores to smelters.

★The Tennessee mine, at Chloride, is again in operation by a crew of 18, who have a contract with the Tennessee Schuylkill Corp. Lead-zinc ore is being mined on the 1,200 level, and the mill is operated when sufficient ore has accumulated in the bins. Selective mining is practiced in order to insure profitable mill feed. Shipment of concentrates to the smelter will begin soon. Robert Payne is general superintendent of the operation.

TRI-STATE

Experiments under way for use of diesel power underground—New ore strike east of Joplin

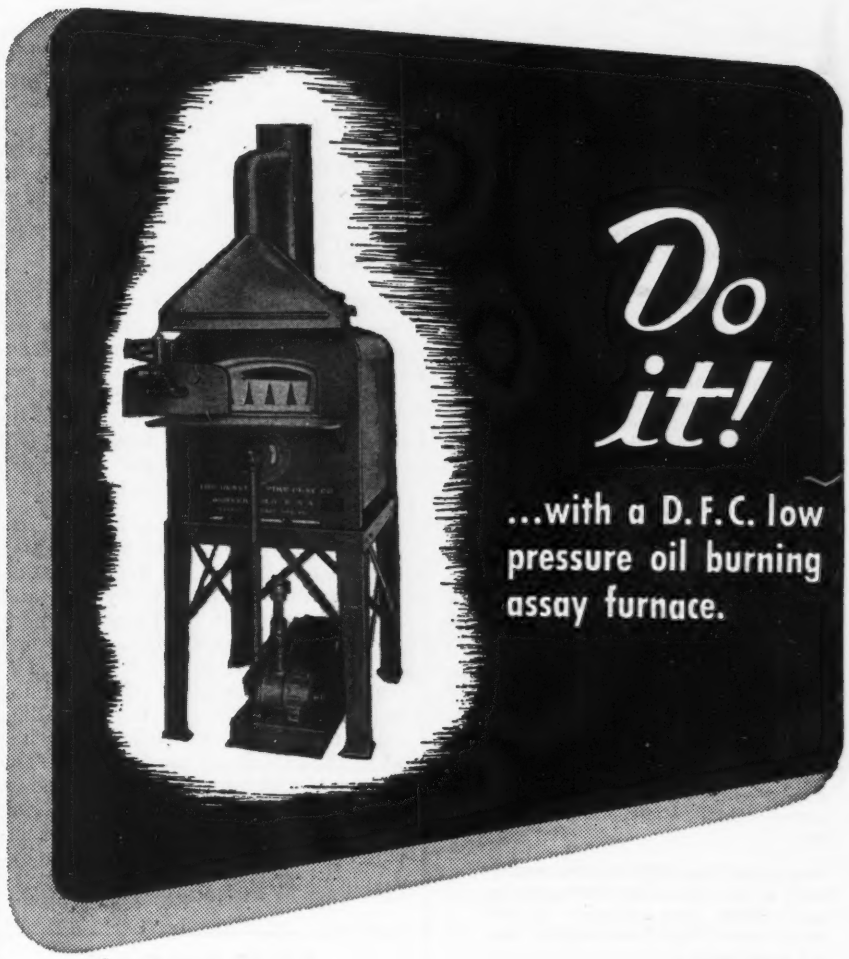
★Ingenuity of Tri-State mine operators continues to contribute in a large

measure toward further development of underground mechanization that has played such an important part in helping sustain a declining rate of production in the face of manpower shortages due to the war. Experiments are being conducted by the Eagle-Picher Mining & Smelting Co. with exhaust gases from diesel-type engines in an effort to make this cheap, mobile power available for handling larger tonnages underground at lower costs. It holds possibilities, if made practical in complying with state mining laws, of eventually eliminating such things as airlines and track haulage entirely. For the present, at least, this development is in the experiment stage.

★However, under more favorable conditions of ventilation, Fenix & Sons have actually demonstrated the possibilities in their Orongo mines by introducing bulldozing underground, using an International diesel-powered TD14 dozer in conjunction with an International diesel loader mounted on caterpillar crawler. The bulldozer moves the ore into piles 5 or 6 ft. in height to be scooped up by the front-end loader into underground haulage trucks. The trucks haul to an underground hopper into which the ore is dumped and subsequently drawn into cans for hoisting at the company's Steel shaft. The loader fills a 4-ton truck in less than two minutes, making two scoops of 2 tons each. The loader weighs nearly 15 tons and its scoop is 6 feet wide. It has been in use several months. The bulldozer, introduced the forepart of February, supplements the loader in making larger tonnages available for easy and quick loading. Without this equipment and confronted with the tight labor situation, the company would have been unable to maintain anything like its present schedule of operations, which can now be expanded, Fenix said. The mine property is connected underground on the 220-ft. level with the four-acre famous open-pit mine of the Oronogo Mutual Mining Co., which makes possible the use of diesel power underground by a favorable ventilation condition that readily eliminates noxious exhaust gas that might otherwise be harmful to the miners.

★Four-Mile Mining Co. is sinking a new shaft on the T. R. Smith land, about 6 miles west of Picher. The shaft is situated a few hundred feet north of the West A St. road out of Picher and just west of Four-Mile Creek. The shaft has been sunk to a depth of 175 ft. and will continue to a depth of 225 ft. into a zinc-lead orebody blocked out by churn drilling a number of years ago and more recently tested by further drilling by the developing company. V. A. Walters and associates are interested in the new development in a virgin area, situated about midway between the development of the United Zinc Smelting Corp. on the Park-Walton to the west and the great Picher field proper to the east.

★W. D. McMillan, of Rolla, Tri-State



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Tri-State (*continued*)

district engineer for the U. S. Bureau of Mines, reports a rich strike of zinc-lead ore on land held by Tom Phelps, of Joplin, in the old 1,000-acre tract east of Joplin, situated south of Thirteenth St. and east of the Rangeline. The drilling showed 65 ft. of ore assaying 4 percent metallic zinc and 4.80 percent lead. Fifteen feet of the hole averaged better than 20 percent in metallic recovery values, McMillan said.

★Eagle-Picher Mining & Smelting Co. has resumed operations at two mining properties in the Picher field. They are the Gordon No. 2, west of Treece, in Oklahoma, and the Cherokee, or Webber west, shaft, north of Picher, in Kansas. Ore from the two mines will be shipped by rail to the company's Central mill, south of Cardin.

★The Webb City Custom Mill Co. has resumed operations at the Sciota tailing mill, east of Webb City, and is treating tailings from the old Smoky Hill and Avondale mines, in the Prosperity mining area, south of Carterville, according to Ray B. Gaunt, of Webb City. The company has enlarged the receiving hopper and revamped the unloading ramp at the mill, which had been idle since the middle of last October. The company, which formerly contracted its hauling, will now do its own, having acquired larger trucking equipment, including 10- to 15-ton trucks with hydraulic dumps.

ARKANSAS

Metals Reserve making large shipments of manganese ore from Cushman and Pfeiffer

★Production in the Batesville-Cushman manganese field in January sagged below that of December. Total production in January ran to approximately 717 tons, of which 387 tons was low grade and 340 tons high grade. December production ran to 890 tons. The January sag was caused by bad weather and the new specifications which were put into effect by Metals Reserve on Jan. 1. The buying depot at Batesville will not purchase any ore now that runs less than 42 percent manganese or any that carries more than 0.03 percent phosphorus.

★The largest shipments of ore ever made from the field are now going out. Metals Reserve has shipped in January and will ship in February a total of 4,000 tons of low-grade wad to the Woodward Iron Co., of Woodward, Ala. Up until Feb. 1, 45 carloads have been shipped from the Cushman stockpile, and a big tonnage will start to move soon from the Pfeiffer stockpile.

★The Davis Mining Enterprises concentrating plant got into active operation about the middle of January, and has turned out approximately 100 tons of high grade. Another 97 tons was washed and concentrated on the Hendricks plant on the Polk Southard property, which they took over in December. Their new plant is located on the latter property on the Bayou near Cushman. All of the ore on the two properties meets the new Metals Reserve specifications. To increase the production of the new plant they will install soon two more sets of double-log washers.

★Two mining operations are now being conducted in the Calamine zinc field. T. J. Lassiter, operating the Penn mine, has started mining operations on the property, and expects in the near future to install a 20-unit Freeman metals separating mill, a dry separation process. The United Zinc Corp., of Little Rock, with operations in charge of Charles Gunter, of Eaton, is conducting mining operations on the Casper property. They are building up a crude stockpile which will be milled by a Freeman dry process plant of 30 units.

★The Arkansas Mining & Refining Trust Co., under John L. Stone, of Harrison, has taken over and is now operating the Advance Mining & Engineering Co. property, on Crooked Creek a few miles east of Harrison. Milling operations have been discontinued, and run-of-mine zinc sulphide is being shipped to Eagle Picher in the Tri-State field.

★S. & G. Inc., operating the Hurricane mine, in Searcy County, near Pindall, has suspended work temporarily because of shortage of water necessary for the operation of the large concentration plant. Rainfall in that area during the last year has been below normal and dams are now being built in hope of overcoming the difficulty.

★James Rogers, of Harrison, Ark., operating the Coon Hollow property in the Zinc, Ark., district, has purchased mill equipment and lumber for the construction of a concentrating plant. He expects to start construction within the next 30 days.

★C. R. Prunty and associates, of Little Rock, are now conducting mining operations on the Dolly Agnes and Gladys Marie mines, near Buffalo, in Marion County. One tunnel on the Dolly Agnes is in 50 ft., and another on the Gladys Marie, 75 ft. Both are in good runs of high-grade zinc carbonate that carries some cadmium.

★Lewis Flader and associates, operating Mine 16, near Buffalo, in Marion County, have one tunnel in to a depth of 650 ft. and another to a depth of 230 ft., both in good deposits of zinc carbonate which carries cadmium from 0.20 to 1.84 percent. Operations are in charge of Lewis Flader, who now has headquarters at Yellville. They have also prospected the surface of the outcropping ledges covering a distance of 316 ft., and these have shown good carbonate content. A new road to the mines has been completed and a milling plant will soon be built. The

equipment will consist of jaw crusher, rolls, ball mill, classifier, tables, and a selective flotation unit.

★Hedges and Huer have taken over the lease on the Brewer property near Ponca, in Newton County, and are now in production. Operations are in charge of Ova Hedges, Hilltop. The first car of ore was shipped to the Athletic smelter, at Fort Smith, on Feb. 8.

★The U. S. Bureau of Mines is carrying on diamond-drill exploration on the recently discovered Gap Mountain barite deposits near Caddo Gap. Surface showings are favorable, and it is hoped that a large deposit of barite will be proved by the drilling program. J. R. Thoenen, of Little Rock, is district engineer for the Bureau and R. B. McElwaine is the field engineer in charge of the drilling program. The drilling contractor is the Dundee Engineering Co. of Dundee, Ill.

★It is reported that the Magnet Cove Barium Corp., of Malvern, is contemplating sinking an inclined shaft under the barite deposit now being stripped near Magnet Cove. This would necessitate a shaft 700 to 900 ft. in depth in the Arkansas novaculite formation. Harry Brown, of Malvern, is the president and general manager of the company.

★A churn-drilling program by the U. S. Bureau of Mines on the titanium property of the Magnet Cove Rutile Co. is under way. It is hoped that a large tonnage of commercial ore will be proved. The cuttings from the churn drilling will be used as material for metallurgical research. Metallurgical problems preventing adequate recovery of the rutile have long been an important factor barring the way to successful operation of this property. The district engineer for the Bureau of Mines is J. R. Thoenen. The engineer in charge of the drilling program is R. V. Spencer. A. J. Hoffman of Louisville, Ky., is the drilling contractor.

MICHIGAN

More copper wanted by WPB—Scraper used in mucking out shaft—Accidents few in 1944

★Mining companies in the Michigan copper district have received letters from F. H. Hayes, assistant director of the copper division of the War Production Board, stating that, due to urgent demand for the metal, the copper industry has been placed on the "critical products list" and men employed in it are being given high priorities for deferment under Selective Service. Pointing out that there is need for an additional 4,000 workers in the copper mines and mills of the country, Mr. Hayes said that the increased Army ammunition program, "translated into refined copper, means an increase over previous U. S. requirements of 57,000 tons of

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Michigan *(continued)*

refined copper per average quarter for 1945. Compared to our estimated rate of mine production in the fourth quarter of 1944, the total new requirements will be an increase of 9 percent over production." Workers are urged to stay on the job and work "a little bit more" to make sure the copper needs of the ammunition program are fully met.

★Calumet & Hecla Consolidated's new shaft at the Central location, in Keweenaw County, has reached a depth of 458 ft. below the collar. It is about 325 ft. from the rich fissure vein which is to be mined. A plat is being cut and a crosscut will be driven to the ore, which will probably be reached the latter part of March. The shaft is 5x12 ft. inside the timber, with a 5x5¼-ft. skip compartment. The ladder, dump, and pipe compartment is 5x6 ft. A two-ton skip is being used.

★In the past two and a half months over 3,000 tons of rock has been moved from the old stockpile to the loading ramp at Allouez for transportation to the mill.

★During December, the new Iroquois shaft of Calumet & Hecla Consolidated, in Keweenaw County, produced more than 215,000 lb. of copper, all of which was taken from stopes. It has reached a depth of 2,149 ft., and stations and plats have been cut for the 19th and 20th levels. Hoisting from the bottom has been started. Despite severe weather conditions in the latter part of December and early in January, operations continued without interruption.

★Mucking in the Calumet & Hecla's Allouez shaft has been speeded and simplified by adoption of scraping. The scraper, made in the company's shop, is operated by a 25-hp. tugger hoist anchored in the foot above the slide. It is built so that it does not lose its load while going over the foot. The bail is extra heavy. A pan is placed under a steel slide sloping down the shaft and is equipped with a door which drops on the bucket while loading, but holds the load in the pan while the bucket is traveling. This scheme has proved better than hand mucking methods of past years.

★Three men out of a total of 1,096 employed underground in Houghton County in 1944 were fatally injured in mine accidents. The percentage of casualties was 0.0027, compared with 0.0051 in 1943. The draft, as well as other factors, made inroads on underground employment in 1944, the total being 318 men less than in 1943. The number employed in mills and on surface was 2,064. For underground and surface the total was 3,160.

★In Keweenaw County no fatal accident occurred in the mines last year. There were only 20 compensable accidents in the four operating shafts. An average of 576 men were used underground, all by Calumet & Hecla. On surface the average was 196.

IRON COUNTRY

A new manganese mineral—Steep Rock to ship 800,000 tons this season—More ore from Michigan

★After operating on a five-day week production basis since June, all active iron mines on the Marquette and Menominee ranges increased their schedules Jan. 21 to six days per week at the request of the War Production Board. As time-and-one-half is paid for time in excess of 40 hours per week, this means an addition to the payroll of about $10,000 on the Menominee and twice that on the Marquette range. These underground properties are being pushed because it is realized that the open pits of Minnesota cannot continue mining high-grade ores at the rate of recent years. Another reason is the declining supply of scrap iron. The steel plants will be short 5,000,000 tons of scrap this year, which means that an additional 10,000,000 tons of ore must be supplied.

★At the Carey mine, on the Gogebic Range, the enlargement of the 5½-ft. borehole to shaft size is proceeding on schedule and is now almost 700 ft. below the collar. The two-drum skip hoist, driven by a 1,000-hp. induction motor, operates two sinking cages in balance. The switchboard has been installed in the engine house, and the new 3,600-c.f.m. Sullivan compressor supplies all needed air. The headframe has been inclosed with sheet iron so that the work of sinking will not be interrupted. The ground for stockpiling east of the shaft is being filled in. No shop equipment will be installed until this summer.

★When the contracts between the C.I.O. union and the managements of the companies involved were up for renewal in January on the Marquette Range, the C.I.O. presented a program covering 24 points that affected the iron-mining industry besides recommending that management follow the directive on basic steel as to wage increases. The companies rejected the program because several of the points meant higher operating costs. The union placed the matter under the jurisdiction of the War Labor Board when no agreement could be reached, and is expecting a decision soon. The C.I.O. also recommended that the decision be retroactive to Jan. 4 as regards the wage increase.

★Due to exhaustion of ore in the Lake Superior-Holmes mine, at Ishpeming, Mich., the Oliver Iron Mining Co. has stopped work there and is taking the mining equipment out. Despite the extensive program of dewatering the old workings and driving exploratory drifts during the last two years, no new ore could be located to justify further operations. These mines have been consistent producers for many years.

When the Oliver company took over the Holmes mine from Cleveland-Cliffs in 1930 it exhausted its Sec. 16 mine to the south and its Hard Ore mine to the east through this shaft. Together, the three mines produced over 17,500,000 tons of ore between 1888 and 1943. The Hard Ore mine was one of the first to be opened in this district and had an unbroken record as to shipments from 1858 until 1915, the total in this period being close to 6,000,000 tons. The district office at Ishpeming will not be closed, as the company has other mines which are held as reserves near by. Fred Knight is superintendent.

★Discovery of a new manganese mineral in Minnesota iron ore deposits was recently announced by Dr. John W. Gruner, University of Minnesota geologist. Dr. Gruner said the mineral is simple in composition, containing only manganese, hydrogen, and oxygen, adding that the find is unusual because most simple minerals have long been known. It has been named "groutite," in honor of Dr. Frank F. Grout, head of the Minnesota Geological Survey. Groutite was first called to Dr. Gruner's attention by H. J. Hakala, Duluth mining engineer, who believed it to be a magnetic iron ore. Dr. Gruner said it occurs in beautiful, large specimens of hundreds of jet-black crystals and thus far has been found only on the Cuyuna Range.

★Cleveland-Cliffs Iron Co. is installing a Dorr hydroseparator and sizer this winter at its Holman washing plant, at Taconite, Minn., on the Mesabi; also a Roberts & Schaefer hydrotator. These machines will be used in recovering fine ore from tailings.

★M. A. Hanna Company is making an addition to its washing plant at the Portsmouth mine, at Crosby, Minn., on the Cuyuna Range, and is remodeling it.

★Steep Rock Mines, Ltd. Atikokan, Ontario, expects to ship about 800,000 tons of iron ore during the 1945 season. About half of this tonnage is expected to be shipped to the docks at Superior, Wis., for transport down the Lakes, inasmuch as the dock now being built by Canadian National Railways will not be completed until the end of the season.

★The Inter-Range Mining Co., just formed, will operate the Minnewas and the Sullivan-Larkin mines, at Virginia, on the Mesabi, when operations start in the spring. C. H. Taylor, of Duluth, is president; E. A. Young, of Hibbing, vice president and treasurer, and D. D. Haley, of Hibbing, secretary. The Minnewas is an open pit formerly operated by the Oliver company and later by Evergreen Mines Co. The Sullivan-Larkin is an open-pit mine.

★A steel-cable conveyor belt, similar in type of construction to the one installed at the Morris open-pit mine two years ago, is to be provided for the Gross Marble mine, near Marble, Minn. Both properties are on the Mesabi and are operated by the Oliver Iron Mining Co. The new belt, it is understood,

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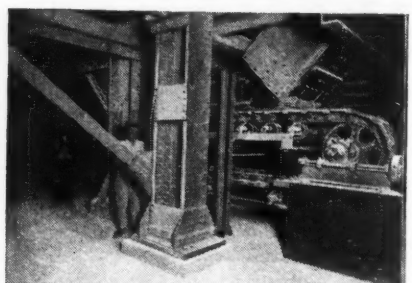
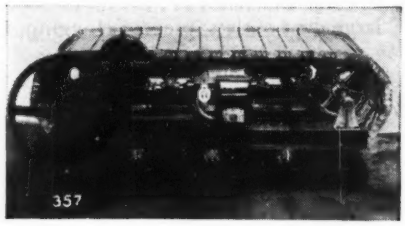


A-348 shows the tail end of one of the 42'6" x 48" x 12" link Amsco-Brayton apron feeders installed at Inspiration, Arizona.

The pan showed about 1/16" wear. The chain link showed a little wear on the sprocket side of the barrel. However, the link pitch was 12" and six links still measured 72". Pins had never been reversed or renewed and the tail end take-up had not been moved for several years.

Sprocket teeth showed little wear and the sprockets had never been reversed. Tail idlers and track wheels showed no appreciable wear. The shafting, bearings and drive which were built by the mining company have never required any repairs.

This is an outstanding performance record and from the condition of the feeders, as reported, they should be good for another 15,000,000 tons each. The ability of Amsco-Brayton apron feeders to "take it" year in and year out is due in a large part to the use of austenitic manganese steel—"the toughest steel known" — in their construction. Sound design, a contributing factor, includes use of fixed track wheels instead of link rollers; knee-joint non-sagging chain and one-piece overlapping pans that eliminate fouling, and minimize leakage and spilling.



No. 357 is a side view of a working model of Amsco-Brayton apron feeder showing features of design.

For more information about the many mining conveyor problems solved with Amsco-Brayton patented apron feeders, write for Bulletin No. 643-AF.

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Iron Country *(continued)*

will deliver the ore without transfer in one continuous operation to a point 257 ft. above the pit bottom, as compared with 249 ft. at the Morris mine. Like the other belt, it will operate at 13½ deg. This type of construction, it is claimed, will permit a maximum of troughing in the belt's load-carrying center, simplifying the training of belt.

WASHINGTON

Aluminum production ordered increased to plant capacity—Germania tungsten mine sold

★The eighteenth annual meeting of the mining institute of the School of Mines, University of Washington, in January, was the largest held in several years. Washington State Legislature was asked to appropriate $25,000 for prospecting schools at the University of Washington and Washington State College. The bill authorizing these schools was passed two years ago, but no funds were appropriated. The purpose is to promote the development of the mineral resources of the State by setting up a vocational training program where those who are unable to attend any institution of higher education may receive instruction in mining, prospecting, and mine engineering.

★Northwest Mining Association presented to the Legislature a strong program for what is considered needed legislation (*E.&M.J.*, Feb. 1945, p. 170). Joseph Hurley, a former member of the Legislature, went to the State Capital on behalf of the Association and presented the proposed measures, which were well received.

★Talisman Mining & Leasing Co. has filed articles of incorporation at Olympia and will develop the old Laurier mine, in northeastern Stevens County. Albert S. Ryland, of Seattle, and Charles House, Art J. Corbett, of Spokane, and others, are the incorporators.

★Blake F. Titcomb, of Minneapolis, representing himself and others, has taken over the old Germania tungsten mine, in southwestern Stevens County. He has put a crew to work and expects to have the property producing wolframite early this spring. Henry Becker, of Colville, who has been superintendent of all previous operations, is again in charge. General Electric Co. was the last concern to get any production out of this mine. That company disposed of its holding a few years ago to Robert H. Mills, of Spokane, who has now turned it over to the new owners. This property has had a record of production since the early days of the first World War, when German interests mined the ore and shipped it to the Krupp ordnance works in Germany.

★Aluminum Company of America has been instructed by WPB to step up

production to full capacity at its Mead and Trentwood plants, near Spokane. As to postwar operations, the College of Economics and Business at the University of Washington estimates aluminum production in the Pacific Northwest will ultimately be twice the volume of prewar production of that metal in the nation. This demand may result in the construction of a large alumina plant in the Northwest. President Earl H. Braden of the Spokane Chamber of Commerce says development of Spokane's light-metal industries will be a major project of that body this year. More than 2,800 men are now employed at the aluminum plants in Spokane, and it is stated that the ultimate number will exceed 4,000. Production at the Trentwood rolling mill has already reached heavy proportions. It is said that in one 8-hour day in January the Trentwood crew rolled sufficient aluminum sheet to make 110 heavy bombers.

★Equipment is being installed at the Electric Point mine, in northern Stevens County, according to Paul S. Seeley, of Cambridge, Mass., representing new owners. Old tunnels and other workings are being restored.

★Dr. A. E. Drucker, retiring dean of the College of Mines at Washington State College, Pullman, reports that that institution has turned out 55,000 magnesium castings for aircraft plants.

CALIFORNIA

Renewed agitation to resoil dredged land—Value of 1944 gold output lowest since 1848

★According to a recent press release by Walter W. Bradley, State Mineralogist, Ferry Building, San Francisco, total value of mineral production of California for 1944 is conservatively estimated to have been $451,553,000. This figure exceeds by $25,108,000 that of 1943. Gold production, 113,500 oz., was the smallest for any year since 1848. Copper production is estimated at 24,150,000 lb.; lead, 11,076,000 lb., zinc, 15,767,000 lb.; and silver, 763,700 oz. Reports indicate that the 1944 production of quicksilver is lower than that of 1943, which amounted to 24,250 flasks. Total value of other metals, including chromite, iron ore, manganese, molybdenum, platinum group metals, and tungsten, is estimated at $10,825,000. Industrial minerals again showed a slight increase over the record of 1943, as did the saline group.

★The gold-dredging industry again is confronted with the problem of resoiling. State Senator H. E. Dillinger recently has introduced S. B. 37 in the Legislature, which would require dredge operators to replace the dredged-over land in the proper geological order, with gravel on the bottom and soil and fines on the top. Senator Dillinger stated that, "We have had the dredger debris problem for 40 years . . . during which

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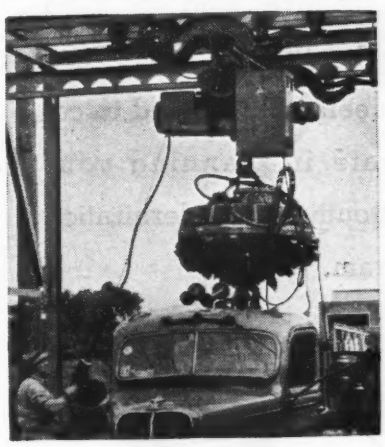

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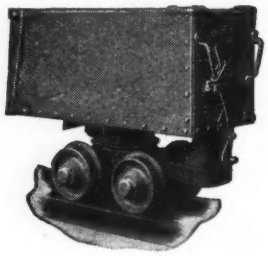

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California *(continued)*

time these great dredges have crawled and wallowed across the land, eating an acre every five days, and leaving only rocks behind like destroying monsters. That land will never again pay taxes or produce wealth, employ labor or delight the eye of the onlooker. We sing lustily, 'I love you, California'; then sit down supinely while this small selfish group despoils our green valleys." Opponents of the measure point out that most of the land dredged is too poor for agricultural purposes, the acreage involved is infinitesimal compared to the total land under cultivation, resoiling operations have been successful in rare instances only, resultant gravel constitutes millions of tons of rock for road making and building construction, some of the gravel piles already have disappeared, and that passage of the bill would adversely affect the future jobs of many mining men, mechanics, and others.

★Opposition is being voiced in Washington by southern California mining associations to the proposal that the Inyokern Naval Ordnance Test Station be extended from its present size of 394,000 acres, to include an additional 246,000 acres, principally in Inyo County, and reaching to within two miles of Darwin, well-known lead mining district. The mining committee of the Los Angeles Chamber of Commerce reported unfavorably on the plan, urged that the government ascertain if lands owned elsewhere could not be used for the purpose required, and insisted that in the event of such acquisition the area be used for the period of the war only, and that in so far as possible the mines and potential mines be excluded by reducing the area of the proposed extension. The action was approved by the Chamber's directors.

★It is reported that F. W. Sprung plans to reopen the Downs gold mine, near Volcano, Amador County, as soon as gold-mining restrictions are lifted. The property was recently purchased from Downs and Hanford, of Jackson, and according to available records was first worked in the 80's.

★Milling operations are reported to have been started at the copper-gold property of Pioneer-Lilyama Mines, situated in the Pilot Hill area of El Dorado County, where installation of a 250-ton flotation mill was completed recently. Pioneer-Lilyama Mines, formerly known as Volo Associates, is headed by O. H. Griggs, general manager; E. L. Reeves, who serves as chief mining engineer and geologist; and Mrs. Freda McGill. H. Rosborough is general superintendent.

★The old Noonday copper mine near El Dorado, El Dorado County, has been unwatered and sampling and preliminary exploratory work are in progress. The mine is developed by a 200-ft. two-compartment shaft, with levels at 100 ft. and 200 ft. Operations are directed by L. C. Baldwin, and plans

are being completed to treat mine production at the mill of Volo Mining Co., about 7 miles distant. S. T. Hilberg, of Sacramento, holds the lease on the property.

★Limited hydraulic mining operations under wartime restrictions are scheduled to be resumed soon in the Junction City, Weaverville, and other nearby districts in Trinity County. John W. Bergin is planning to work the Bergin placer property, three miles south of Junction City, which has been operated profitably for more than 50 years, and a number of gold dredging operators are prepared to resume work as soon as the ban on gold mining is terminated.

ALASKA

Rapid postwar mining revival indicated—Miners advised not to push Alaska Juneau claims

★Mining men of Alaska are opposed to the suggestion that the mining equipment which has been acquired by the government be shipped out of the Territory. At a meeting of Alaska Miners Association, in Seattle, Jan. 24, Ralph Lomen, of the Lomen Commercial Co., presented the matter, and President Charles Johnston appointed a committee to prepare a resolution opposing the shipment of such material to the States. Equipment dealers would prefer to see the equipment sold directly to miners to help the reestablishment of the industry, as soon as gold mining can be resumed.

★Chester Milligan and Jack LaCross, of Fairbanks, have purchased the placer ground of the Ophir Gold Dredging Co., extending 25 miles along Ophir Creek, in the Nome district. In early days it was known as the Wild Goose property.

★B. D. Stewart, Territorial Commissioner of Mines, says there will be a rapid revival of mining as soon as wartime restrictions are removed and men and materials are again easily available in the Territory. "This revival will be quick and complete in the mining industry in all parts of the Territory," he said. "This already is in evidence with many letters of inquiry coming to my office from workers in war industries in many states and from soldiers on many war fronts. Many of these soldiers have families and wish to make their home in our Territory."

★W. R. Travis, attorney for the International Union of Mine, Mill and Smelter Workers, has advised the men to have patience and not push at this time their claims against the Alaska Juneau company to collect back pay. He said the attorney general has ruled the War Labor Board cannot confiscate any of the surplus funds with which to pay back wages, and he said the mining company's current revenue was only what money it obtains from selling electricity to the city of Juneau. He

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Alaska *(continued)*

told the men to continue to push their claims through legal channels and to try to get the War Labor Board to reopen the case.

★E. L. Keithahn, curator of the Territorial Museum at Juneau, reports the receipt of long-fibered minerals from the Jade Mountain area. Among them are chrysotile, a variety of asbestos that can be woven; jade for possible use in native crafts as a rival of oriental jades; and a long-fibered asbestos for chemical filters.

★A large freighting expedition consisting of 4 "cats" and 19 sleds left Fairbanks the last of January for the south fork of the Koyukuk via Livengood, Stevens Village, Wiseman, and on to the mining property on Smalley Creek. The freighting unit is equipped to take care of necessary repairs, and wanigans provide comfortable living quarters for the men who keep the train moving for two shifts each day. About 185 tons is being freighted, the heaviest piece of equipment being a ¾-yard dragline. This past summer additional freight was landed by boat at Stevens Village, which will be picked up by the train. A total of about 500 tons is being moved and the distance traveled exceeds 300 miles. The placer properties which will be worked were purchased by Gus Uotila and partners, and include the Eli Hansen claims on Smalley Creek and the Fritz Werther and Henry Mishap properties on the south fork of the Koyukuk. Prospecting and a small amount of work was done on the property last summer, and the new equipment will enlarge operations this coming season.

★The Denali Development Co., Sam Gamblin and associates, headquarters in Fairbanks, has an option on 58 placer claims on Kenai River. The property is 1½ miles from Cooper Landing, on Kenai Lake. A placer drill is being shipped from Fairbanks, and the river channel will be drilled through the ice until the break-up. The same company has purchased the Primrose property, which is 18 miles from Seward and 4 miles from the Alaska Railroad. A 10- to 15-ton mill was built on the property in 1930 and it was used until a snowslide wrecked it in 1934; after that some ore was shipped to the smelter. The mill will be rebuilt this year if a permit can be obtained.

★Better air service to Alaska through the use of DC3 planes is now being provided by Pan American Airways. Delays that have been occasioned by the need for contact flying in southeastern Alaska will be substantially reduced since C.A.A. has granted permission for night and instrument operation between Annette Island and Gustavus, and between Gustavus and Whitehorse, Y.T. For the past two years P.A.A. has had night and instrument operation between Whitehorse and Fairbanks, and within the past year similar operation has been extended to the Seattle-Annette Island run.

★This past season Bruce Thomas, of the Fairbanks office of the U. S. Bureau of Mines, investigated tin deposits on the Tozimoran and Moran creeks, two streams entering the Yukon River from the north near Tanacross. Asbestos deposits on the Forty Miles, Healy, Volkmar, and Goodpaster Rivers were examined and quartz crystal occurrences on the Goodpaster River and at Big Delta, on the Tanana River, were inspected. A trip was made to the platinum properties at Goodnews Bay.

★The Flora and Nellie group of claims in southeastern Alaska which were located in 1900 by George Jervis and William Crowell have been optioned by a Tacoma syndicate. The property is on Prince of Wales Island and lies about 7 miles west of Hollis. Some trail and repair work may be started soon, but mining operations may not begin until the war is won.

★Santiago Mines, Ltd., has acquired an option on and proposes to reopen the Dolomi mine, on Prince of Wales Island, southeastern Alaska. The property is equipped with a 200-ton pilot mill which is capable of expansion. About 5,000 ft. of lateral underground work, in addition to shafts and winzes, has been done. There is understood to be a substantial body of ore averaging approximately $10 per ton as well as a considerable accumulation of milling ore on the dump. A power development near the mine is sufficient to take care of all requirements.

★The Lucky Nell Mining Co. has been organized by a group of Tacoma, Wash., men to exercise an option on property near Hollis, Prince of Wales Island, about 40 miles from Ketchikan. The purchase price of $50,000 is payable from 12 percent of net income from all ore shipped to a smelter. Officers of the company are: Ben. J. Scott, president; H. H. Tilley, vice president; A. A. Grau, treasurer.

CANADA

CIO asks Royal Commission to study mining industry—Company reports reveal many post-war development plans

★Appointment of a Royal Commission to study the metal-mining industry has been requested by the CIO Miners' Union in Canada. The bonus system and welfare benefits paid miners by the companies have been found to be advantages that block efforts to organize workers in some of the camps. CIO has been agitating for a national wage scale, regardless of differences in living costs and individual ability. The companies are making an attempt to maintain the principle of individual incentive in determining wages, rather than adopting a standard scale applying to all workers regardless of individual capacity. Extra pay for extra skill has been a primary principle of the industry in Canada, and this has now

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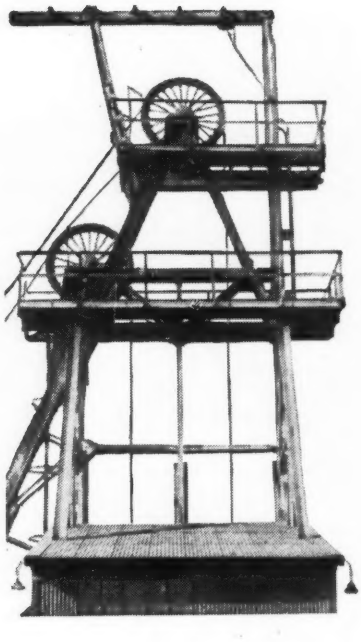

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DANVILLE, ILLINOIS

Canada (*continued*)

been recognized as a major difference to be reconciled by management and labor.

★A. A. Gustafson has been placed in charge of the newly opened Toronto office of Freeport Exploration Co., subsidiary of Freeport Sulphur Co. A pioneer in the production of sulphur in Texas and Louisiana, Freeport has been active in Cuba since 1930 in producing manganese, and controls Nicaro Nickel Co. L. M. Williams, Jr., president, has announced that exploratory work is to be undertaken in Canada

ONTARIO

★Underground development is reported to be in progress on the property of Ontario Phosphate Industries, where surface operations and shipments have been under way for some time. Diamond-drill exploration has been followed by shaft sinking and running a 135-ft. crosscut on the 150-ft. level. A 12-ft. width of good phosphate ore has been announced by the company, which plans to expand production. The property is in Bedford Township, Frontenac County. Canada's 1944 requirements are estimated at 320,000 tons of phosphate rock, all imported from the United States.

★J. P. Norrie, vice president and manager of Purdy Mica Mines, has announced termination of sales to Colonial Mica Co., Dec. 31, 1944, and the negotiation of an agreement for marketing muscovite through Tennant & Sons. Revenue is expected to continue substantially as before, when prices in U. S. funds ranged from 30¢. a pound for third-grade material of small size to $12 a pound for large sheets of No. 1 grade. Net profit in 1944 is estimated at $254,795, compared with $69,953 in 1943. Under a favorable tax assessment, the rate for the 3½-year period from Nov. 1942 is 12 percent. The Purdy property is in the Eau Clair district near the Ottawa River. Muscovite mica reserves were reported in 1943 to be adequate for war requirements of Canada, England, and the United States.

★At the Kirkland Lake property of Sylvanite Gold Mines, sinking the No. 5 internal shaft has reached a depth of 5,400 ft. and is to continue another 100 ft. Sinking has been in progress since 1941. This shaft is in the northwest part of the property and will open a block of 16 levels for development below 3,150 ft. Of five shafts on the Sylvanite property, adjoining Wright-Hargreaves on the east, the No. 2 and No. 4 are the main openings. The original 200-ton mill has been expanded, and in 1940 reached a daily capacity of 600 tons. Since last October, the mill rate has been cut to about 350 tons, due to the labor shortage. Ken C. Gray is general manager.

★The Porcupine camp suffered one of its major tragedies on Feb. 2, when 16

miners at the Paymaster Porcupine mine were killed as the result of a faulty hoist cable. The cage was lowering the men and had reached the 1,000-ft. level when the cable snapped, plunging cage and men to the bottom of the shaft at 2,500 ft.

QUEBEC

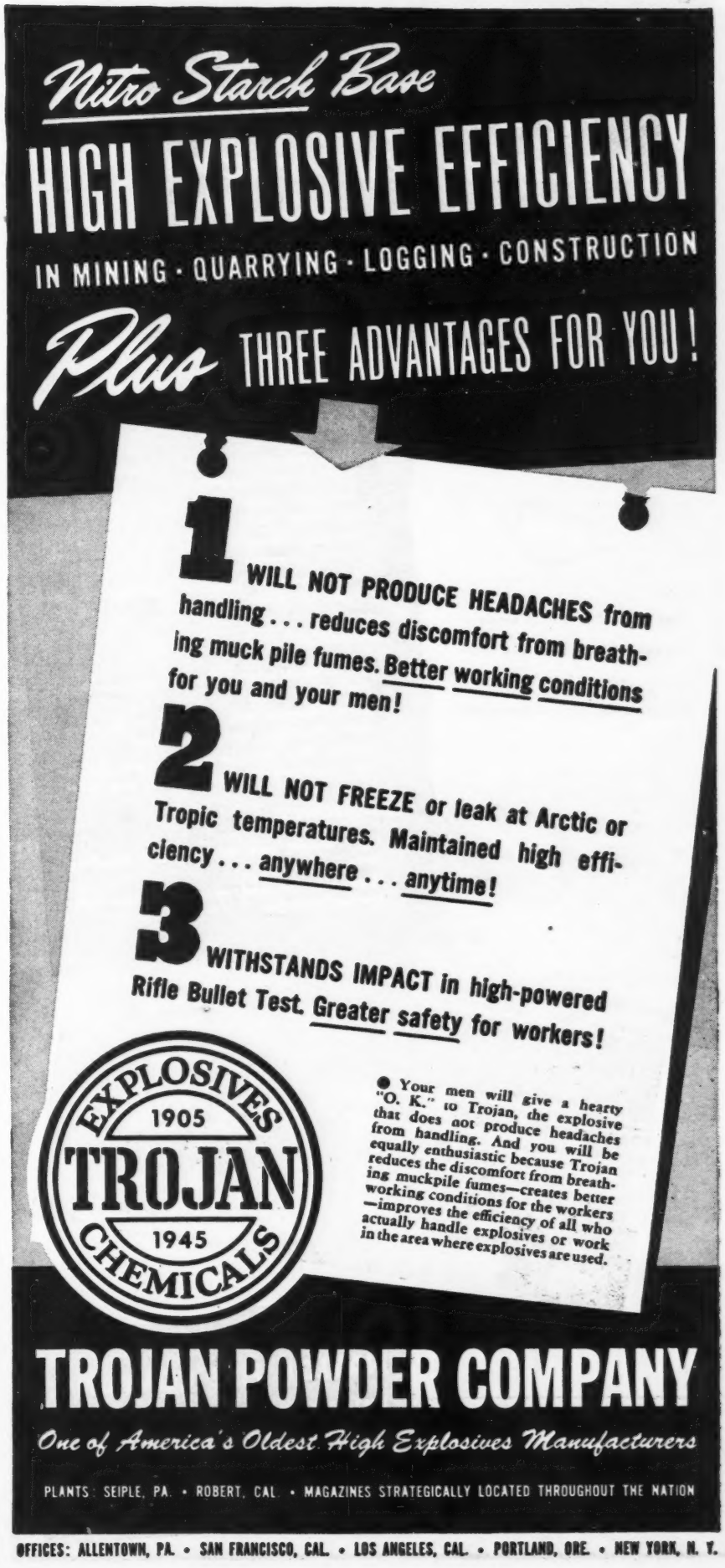
★The milling rate at Normetal Mining Corp. was reported to be 600 tons a day at the end of the year, compared with 530 tons averaged in the first half of 1944. No exploratory work and only limited development are now being undertaken. The output of zinc concentrate is under contract until the end of September 1945. Sixty percent of production to the end of the year, also under contract, and the remainder, optioned to American Metal, will bring 1¢. a pound under the price paid last year. Copper outlets are considered favorable for the second quarter at 11.775¢ a pound plus U.S. exchange, compared with 11.25¢ paid in 1944. Production is being marketed under contract expiring March 31, 1945. J. H. C. Waite is president and J. A. Little is mine manager.

★Three companies holding properties in the Malartic area of northwestern Quebec have announced plans for resuming exploratory and development work as soon as wartime controls are relaxed. These operators are: Rand Malartic Mines, adjoining both the East Malartic and Malartic gold fields; Seventh Malartic Mines, controlled by Perron Gold Mines; and Dubuisson Goldfields. J. P. Norrie, who is consulting engineer for all three companies, reports that drilling results indicate rocks favorable for gold deposition.

★T. G. Woodcock, consulting engineer, reports that diamond drilling, in progress on the property of Astoria Rouyn Mines since September 1943, warrants construction of a 500-ton mill. In the course of drilling a total of 40,000 ft., four ore zones were located having substantial widths and low values. The Cadillac-Bouzan Lake fault, associated with a 150-ft. shear zone, crosses the property for a length of 5,200 ft. Several years ago a shaft was sunk to 250 ft., with development on two levels. R. C. Gamble is president.

★Plans for underground work as soon as government regulations permit have been announced by Charles L. Hershman, consulting engineer, Anglo-Rouyn Mines. The property adjoins the Powell Rouyn mine on the north and is traversed by the Horne Creek fault. Promising ore possibilities have been found north of the fault and 800 ft. east of the old shaft, where seven drill holes have tested the north ore zone for a length of 900 ft. Edwin D. Levinson is president.

★Decision has been announced by the Board of Conciliation, and approved by the Minister of Labor, on matters referred by Local 688 Mine, Mill and Smelter Workers' Union concerning differences with Noranda Mines. The proposed collective agreement concerned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Canada *(continued)*

existing benefits, maintenance of membership, check-off, arbitration, and union rights. The questions of benefits and costs were deferred to the National War Labor Board for action and the decision was given that failure to agree on arbitration within five days should lead to the appointment of a third member of the arbitration board by the Department of Labor at Ottawa. In the proposed Collective Labor Agreement, approval was not given to either maintenance of membership or the check-off, which are opposed by all mining companies in northwestern Quebec as being for the sole benefit and advantage of the Union. A similar conclusion was arrived at by the Board of Conciliation in the matter of Lake Shore Mines and Local 240, Kirkland Mine and Mill Workers' Union.

MANITOBA

★A new contract has been made by Sherritt Gordon Mines for zinc concentrate, to be in effect to the end of September 1945. The agreement is with American Metal at a price slightly lower than under the contract formerly in effect with FEA. The U.S. tariff on zinc concentrate is now $\frac{3}{4}$¢ per pound for contained metal, compared with the prewar rate of 1.5¢. Mill operation at Sherritt Gordon has been reduced to a five-day week as a result of the labor shortage. Monthly recovery is averaging around 800 tons copper and 2,000 tons zinc. Field exploration is being carried on in an effort to discover new ore. E. L. Brown is general manager.

NOVA SCOTIA

★Barite production at the property of Canadian Industrial Minerals, Ltd., expanded from 22,500 tons in 1943 to 114,147 tons in 1944. Last year the product was valued at $1,047,130, compared with $263,419 in 1943, of which operating profit was $118,689. Late in 1944 mill capacity was doubled to 200 tons a day for crushing and pulverizing the material, and expanded washing and storage facilities were installed. Since 1941, output has advanced from 5,821 tons of ground barite for use in oil fields of Trinidad and Venezuela. WPB contracted in 1944 for 10,000 tons ground barite and 50,000 tons crude ore. Heavy orders are reported to be on hand for 1945 delivery. Karl J. Springer is president and Walter E. Segsworth is vice president and consulting engineer of the company, a subsidiary of Springer Sturgeon Gold Mines. The manager is A. D. Dickson.

BRITISH COLUMBIA

★A new labor agreement has been signed by The Consolidated Mining & Smelting Co. of Canada, Ltd., and the International Union of Mine, Mill, and Smelter Workers. The workers have gained further consideration with regard to vacations with pay, overtime, and pay for six statutory holidays. Wage questions and bonuses were not dealt with.

★In an effort to bring wages in the mines in the Hedley district into line with those obtaining in the Bridge River district, joint applications have been made by Hedley Mascot Gold Mines, Ltd., and the International Union of Mine, Mill and Smelter Workers, and by Kelowna Exploration Co., Ltd., and the International union, to the National War Labor Board for an increase of 60¢. per day for all employees at Mascot and Nickel Plate mines.

★Gross operating profit of Silbak Premier Mines, Ltd., for 1944 has been estimated at $69,280 before write-offs. This compares with $329,597 in 1943, the drop being due entirely to the increasing intensity of labor shortage.

★Jason Mines, Ltd., has announced its intention of withdrawing from the base-metal mining field and will not participate further in Twin "J" Mines, Ltd., or the Tyee mine, on Vancouver Island. Olier Besner and James C. Ralston, Twin "J" directors representing the former shareholders of Tyee Consolidated Mining Co., Ltd., have been granted an option to purchase the Jason interest in Twin "J." At present, plant and equipment installed at the Tyee mine by the Dominion Government in its endeavor to obtain production of copper and zinc, although costing originally $260,126, can be procured by the owners for the amortized price of $69,970.

★The first block of 250,000 shares offered to the public at 40¢. per share by the newly incorporated Vananda Mining Co., Ltd., has been oversubscribed. Officers are: president and manager, Dr. Howard T. James; vice president, F. W. Guernsey; secretary-treasurer, Ross Thompson. The property consists of 17 claims at Vananda, on Texada Island, in the Nanaimo mining division. Since development was commenced two years ago by Industrial Metals Mining Co., Ltd., two new orebodies and extensions to two old orebodies have been discovered. More than $300,000 was spent on this development program, as a result of which 128,000 tons of ore, averaging $13.32 in gold, silver, and copper, was indicated. The property is under the direct control and management of Pioneer Gold Mines of B. C., Ltd.,

★Santiago Mines, Ltd., plans a diamond-drilling program to develop properties held on Texada and Lasqueti islands, in the Gulf of Georgia. A contract is now being awarded to provide two drills for the work, and a survey is in progress.

★Production of Bralorne Mines, Ltd., in 1944 was valued at $2,730,728, compared with $2,759,958 in 1943. It has now been proved over a period of three years that this company can maintain output at approximately two-thirds of normal with a crew of less than half that formerly required. Several factors have contributed to this end: the company was able, despite the exodus of workers to war industry, to maintain a substantial

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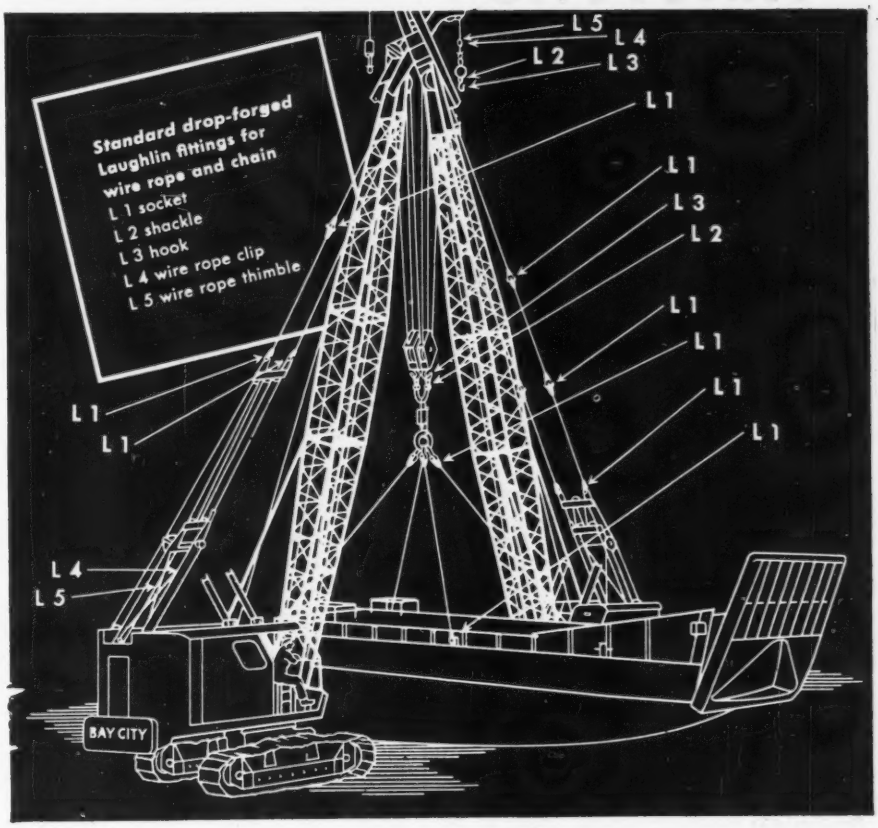

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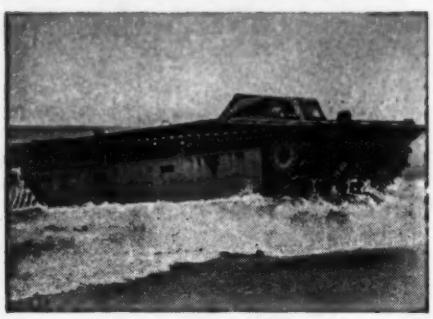

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Canada *(continued)*

nucleus of its most efficient miners; the advanced state of underground development following the sinking of the Crown and Empire shafts to the 20-level made a vast supply of ore readily accessible; and the material increase in the grade of new ore developed and mined permitted a marked improvement in mill heads. Ore reserves, which a year ago were estimated at more than 1,000,000 tons of better than one-half ounce grade, have again been increased in both extent and quality.

★A material increase in the ore reserves of Pioneer Gold Mines of B. C., Ltd., has been indicated as a result of the encouraging development of the "27" vein on the 25 level. The new ore found on this horizon is of better grade than previously developed on the 20 and 21 levels. It is planned to explore, when sufficient labor is available, a vein on the Taylor claims, which were purchased a year ago for $75,000 cash. This lead is thought to be an extension of Bralorne's "51" vein, from which the bulk of that company's production has originated.

★The present major exploration and development program at the Hedley Mascot mine, Osoyoos mining division, is the second step of a plan that has been worked out after an exchange of information and knowledge with officials and engineers of the Kelowna Exploration Co., Ltd., operator of the adjoining Nickel Plate mine. Owing to satisfactory development on the 3700-ft. level, the Mascot is proceeding with a 24-deg. incline raise one thousand feet below the 3,700-ft. level. This is an extensive program and will require an estimated two years for completion. At the start of milling in 1936, known ore was estimated at 150,000 tons. Despite the subsequent extraction of 506,705 tons, valued at $6,281,066, and the payment of dividends aggregating $1,209,544, there was more estimated ore on hand at the end of 1944 than at the start of operations.

MEXICO

Survey discloses additional manganese resources—Mining industry suffering from higher costs and rigidly fixed prices

★Many cross currents in Mexican mining appeared in February, but the industry carried on reasonably well. A fair number of companies and operators have either quit work, some of them permanently, or have asked for sanction to do so. The Labor Ministry is investigating complaints of miners that some companies quit without authorization. The government and mining employers and labor continue to develop a program designed to spare the business much of the grief expected in the postwar period, which some

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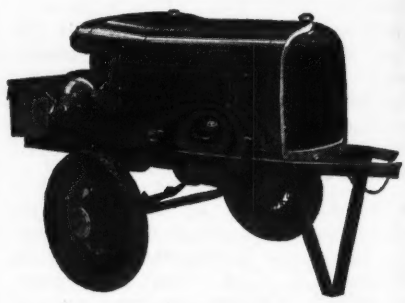

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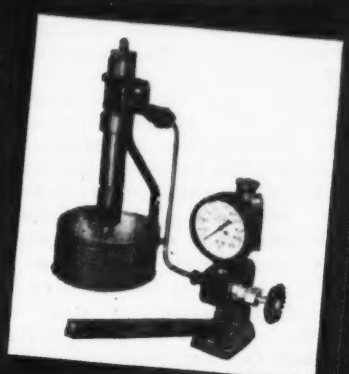

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CHICAGO 40, ILLINOIS

sources opine will start when Germany is knocked out.

★The Ministry of National Economy is optimistic about the manganese survey of Mexico made by the Mexican and U.S. governments. It reports that this survey shows that besides the working deposits, which yield 65,000 metric tons yearly, those discovered can increase that output to at least 80,000. The survey, said the Ministry, discovered black calcite type manganese deposits at Casas Grandes and near Parral, Chihuahua; near Cañitas, Zacatecas, in several parts of San Luis Potosi, near Candela, Durango; in various places in the State of Mexico, and near Arcelia, Guerrero; and contact deposits in northwestern Durango, near Dinamita; at Buenavista, close to Taxco, Guerrero; at Guadalcazar, eastern San Luis Potosi; at Candela, northwestern Coahuila, and near Torreon, Coahuila. Sedimentary manganese was found by the survey only near Santa Rosalia, the Baja California copper mining center. The survey encountered many miscellaneous deposits in many parts of the republic.

★The Cia. Minera Guadalupe, S.A., Guanajuato City, has asked the Federal Board of Conciliation and Arbitration for sanction to definitely suspend work, and to dismiss with indemnifications, its 168 employees. The company told the board that though its business had been flourishing until recently, diminishing markets for its products and increasing difficulties in obtaining essential materials oblige it to quit.

★The board has forbidden the Cia. Minera de Maguarichic, S.A., one of the principal mining companies of the Maguarichic region, Chihuahua, to dismantle its treatment plant or remove any of its equipment until it has paid in full indemnifications ordered for the employees for dismissal when, some time ago, it authorized the company to suspend work. The board is also insisting that the company pay employees full compensation for total or partial disability from illness or injuries from accidents contracted or suffered while in its service. The dismissal indemnifications have been fixed by the board at three months' pay plus 20 days' wages for each year of service per employee. The board allowed Maguarichic to quit when it demonstrated that its high-grade orebodies are exhausted and it is unable to obtain enough ore from other companies in the region to keep its treatment plant going. Maguarichic, in its time a great gold producer, is now about dead. Only a few prospectors continue working.

★The Labor Ministry is seeking, by means of conversations between company and employee representatives, to avert a strike threatened against the Cia. Minera La Occidental, S.A., Etzatlan, Jalisco, unless the company revises the labor contract to allow a substantial pay rise.

★Reorganization for more efficient and profitable work has been started of

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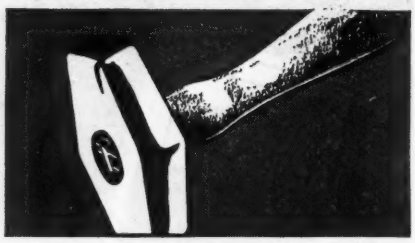

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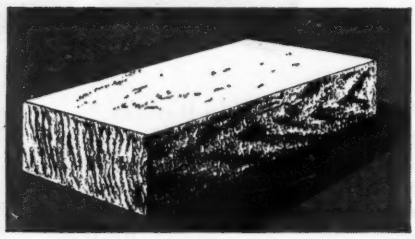

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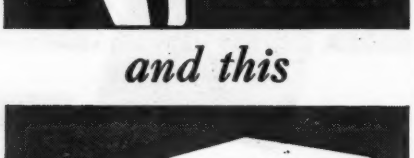

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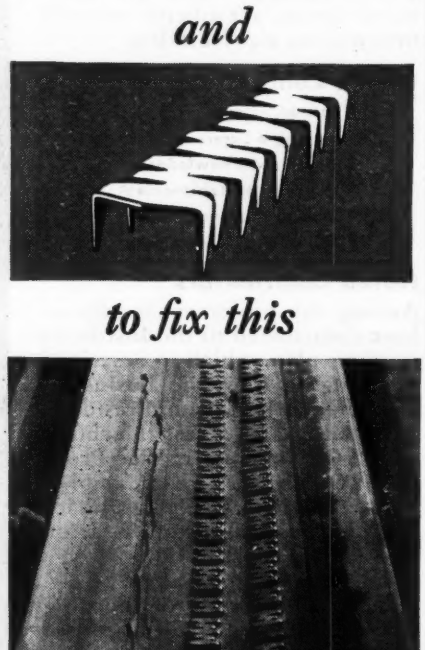

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Mexico (*continued*)

the Santa Fe mining cooperative society, Guanajuato City, by its new officers, headed by Cosmo Avila, veteran miner. The plan features the employment of cyanidation experts which the society is endeavoring to obtain from the important mining zones of Pachuca and Real del Monte, Hidalgo.

★State and municipal government aid in the form of a 150,000-peso ($31,500) loan has enabled the Cia, Minera Paxtitlan, S.A., Guanajuato City, to resume work recently suspended because it lacked funds to obtain spare parts for reconditioning its equipment and machinery. Conversations are being held with a view to placing the company in charge of its employees to work cooperatively.

★The Federal Board of Conciliation and Arbitration has no right to increase amounts claimed by mining and other employees or their kin for indemnifications, according to a National Supreme Court ruling, in a precedent-setting interpretation of the Labor Law. The Court allowed the Cia. Minera Real del Monte y Pachuca, S.A., Pachuca, Hidalgo, appeal against the board's raising the claim the widow of an employee made for compensation for her husband's death in an accident.

★An indication of the decrease in sales abroad of Mexican mining products is indicated by government figures showing that the mines contributed only 117,000,000 to the 511,000,000-peso ($106,000,000) value of Mexico's exports during the first six months of 1944. Vegetable products, valued at 165,000,000 pesos were the largest item in those exports.

★The Labor Ministry announces it is investigating suspension of work by the Cia. Minera La Parreña, S.A., Coahulia, which, it says, took that action without authorization and has deprived 200 men of employment. The company, the announcement says, stopped work because it was unprofitable. The employees are demanding compensation in the form of payment of three months' wages, plus 20 days' pay for each year of service.

★Aid of President Manuel Avila Camacho for Zacatecas miners in a plight it called distressing was asked at an interview with the Chief Executive at his offices in the National Palace, Mexico City, by a delegation of Section 68 of the national miners union. The delegation said that many mining enterprises in Zacatecas have been forced to quit work because it was unprofitable, and asked the President to order mining employers in the State to obey the emergency war law enacted on Oct. 1, 1943, which makes mandatory the raising of wages of all contracted employees in Mexico who earn less than 10 pesos ($2.10) a day. The delegation charged that many Zacatecas mining employers are not obeying this law.

★Surveying the mining industry, the National Bank of Mexico, this country's largest private bank, said: "Despite the government's good efforts for mining, demonstrated by recent measures of a general nature, such as exempting metals and minerals from freight rates increases allowed the railroads (Mexico's four largest), chiefs of the industry do not view the future with optimism. They aver that costs have been inflated greatly of late, while prices of mining products have remained as they were before these increases. That places mining in a disadvantageous position compared with other Mexican industries, for they, while their costs have also increased, have enjoyed an augmentation in their prices. Mining, too, is heavily taxed. But it does not have the protection of higher prices that other industries enjoy. Mining alone has suffered the double pressure of mounting costs and rigidly fixed prices, so much so that many companies in the industry have asked authorization to stop work because it is no longer profitable. Since last October, mining has had a 52 percent rise in cost of combustibles and 15 percent in wages. With the start of 1945, its other costs will be swelled by payments demanded by the National Social Insurance Law. The industry suffered losses of some 10,000,000 pesos ($2,150,000) from the recent strike (the general one of last summer). While metals and minerals have been exempted from increased freight rates, mining has suffered increased costs in those items it must have—machinery, coke, wood, dynamite, chemical products, and clay."

BRAZIL

Production of strategic minerals has made substantial contribution to war effort

★Brazil's part in supplying the United Nations with strategic and essential minerals was recently reviewed by Dr. A. J. Alves de Souza, director of the Departamento Nacional de Producao Mineral, of Rio de Janeiro. He stated that the exports of badly needed minerals for the war industries of the United States, such as rock crystal, mica, rutile, zirconite, tantalite, industrial diamonds and carbonados, beryl, manganese and iron ores and scheelite have played a part of some consequence in the war effort. The heavy demand for such minerals was responsible for a period of nation-wide activity, and the Brazilian mineral industry is now facing a period of unprecedented development which may be of major consequence in the postwar period. Licenses for prospecting issued in 1943 were 2,199, against 1,286 in 1942, 512 in 1941, and only 218 in 1940. More than three hundred new mines were given authorization for exploitation in the period 1937–1943. The main achievements in the production of war minerals can be summarized as follows:

Brazil has long been known as the

leading producer of rock crystal. Production comes from several mining areas located mainly in the states of Goias, Baia, and Minas Gerais. Exports have climbed from 299 metric tons valued at 3,930,000 Cr (1 Cr—cruzeiro—equals about $0.05) in 1937, to 2,411 tons (324,721,000 Cr) in 1943; and 673 tons (178,824,000 Cr) in the first half of 1944. Export prices have gone up from 25 Cr per kg. in 1937 to 265 Cr, a tenfold increase, in 1944. It is to be pointed out, however, that the increase of the average export value is due mainly to the marked improvement in the selection and cutting of the raw rock crystals.

★Production of mica also has reached to new all-time levels, encouraged by the uncertainty during 1942 of shipments from India. Exports rose from 435 tons in 1939, worth 7,890,000 Cr, to 796 tons, valued at 20,326,000 Cr, in 1943; and 492 tons in the first half of 1944, worth 24,168,000 Cr. Here again unit yearly average export values climbed from 18.15 Cr per kg. in 1938 to 49.10 Cr per kg. in 1944, as better standards of cutting, sizing, grading, and classification of mica were obtained. The improvement of marketing methods in the local mica trade has also had some consequence in this increase of production.

★Exports of tantalite were 24,476 kg. in 1938 (Cr 385,398) and 180,816 kg. (6,043,019 Cr) in 1943. The leading producing districts are in the Rio Grande do Norte-Paraiba pegmatite belt of northeastern Brazil, which accounts also for substantial tonnages of columbite, beryl, scheelite, and fluorite. Beryl exported in 1943 was 2,047,411 kg. (2,156,427 Cr) against only 202,665 kg. (105,182 Cr) in 1938.

★Since the discovery of the widely scattered scheelite-bearing limestone formations of the Rio Grande do Norte-Paraiba district in 1942, exports of tungsten minerals increased considerably. Exports of 1943 were 1,167,397 kg. (28,422,178 Cr) against but 2,090 kg. (11,597 Cr) in 1938. The Inhandjara mine, of the Sociedade Mineracao Inhandjara, near Jundiai, Sao Paulo, has just completed its gravity concentration mill and is milling the ore at the rate of 80 tons per day. Substantial reserves have been blocked out by the company, which plans to double the output of wolframite concentrates.

★Brazil is a leading country in the production of industrial diamonds and carbonados. Production comes from several diamond placers in Central Northern Baia, northeastern and southwestern Minas Gerais, Western Goias, northwestern Maranhao, and north central Parana. Exports rose from 18,289 g. (12,675,314 Cr) in 1938, to 39,457 g. (182,277,986 Cr) in 1943. Carbonados are produced mainly in the Lencois placers of Baia, and 1943 exports were 3,899 g. (5,847,217 Cr).

★Exports of iron ore, compact hematite mainly, were 308,878 metric tons (23,929,000 Cr) in 1943; figures for 1944 are not yet available. Exports will be considerably expanded when the Itabira project of the Companhia Vale do Rio Doce SA is completed at the end of this year, when a production of one and half million tons is to be shipped to the blast furnaces of the United States and England. The ore is a pure compact hematite, Bessemer grade. The work at Itabira mine is well under way, as the reconstruction of the Victoria-Minas railway is being completed.

★Exports of manganese ore dropped to 275,552 tons (67,665,202 Cr) in 1943, against 437,402 tons in 1941 (80,374,051 Cr). The Morro da Mina, Conselheiro Lafayete, central Minas Gerais, owned by a subsidiary of the United States Steel Corp., is still the largest producer.

★The Second Pan-American Congress of Mining Engineering and Geology is to be held at Rio de Janeiro in October, it has been announced by A. J. Alves de Souza, chairman of the Brazilian Chapter of the IPIMIGEO (a contraction of Instituto Pan-Americano de Ingenieria de Minas y Geologia), with headquarters in Santiago, Chile. A. Alves Bastos, head of the Divisao de Mineralogia e Geologia of the Departamento Nacional da Producao Mineral, is in charge of the organization of the meeting. Dr. Edward Steidle, chairman of the United States Chapter of IPIMIGEO, and dean of the School of Mineral Industries, Pennsylvania State College, recently attended the meeting of the Brazilian chapter and discussed the organization of the meeting.

★Lode production of gold in the first half of 1944 was 2,701,869 g. (about 86,850 troy oz.) Four companies accounted for this: Morro Velho mine of the St. John d'El Rey Mining Co., Passagem mine of the Cia Minas de Passagem, Juca Vieira mine of the Cia Brasileira de Mineracao SA, and the Ferraria mine of the Minas Leao Junior Ltda. The Timbotuva mine of the Mina Timbotuva Ltda. ended its operation late in 1943 when the reserves were mined out. Eighty-nine percent of the lode mining gold production comes from the old Morro Velho group, which has been in operation for 113 years continuously. Reserves of ore are 6,213,000 tons carrying 11.82 grams per metric ton, about 0.381 oz. per ton. With adjoining mines of Espirito Santo and Bicalho, total reserves of the St. John d'El Rey are reported 9,453,000 tons. Gross profits of this concern were £1,238,957 in 1943, with net profits of £339,182. The company has produced also in the first half of 1944 70,165 kg. of silver (about 2,302,000 oz.) and 313,081 kg. of white arsenic as byproducts.

CHILE

Renewal of U.S. contract for purchase of local ores held essential to Chilean industry

★After an almost continuous sojourn of 35 years in this country, Horace R. Graham recently left Chile for New

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Chile (*continued*)

York to take up his new position as president of both the Lautaro and Anglo-Chilean Nitrate companies, which, together, are by far the most important producers of natural sodium nitrate in their large, highly mechanized plants of Pedro de Valdivia and Maria Elena, Antofagasta. Mr. Graham's first acquaintance with Chile's mining industries was at the old Fortuna mine, at Braden Copper, where he came as a young graduate to take up his duties as a green shift boss to direct the work of the Chilean "roto," then an unknown quantity to him, but whom he later knew, appreciated and handled so well. He soon became known as the "colorao," the redhead, a hard worker and a hard driver but withal a just and humane leader. His men said that no one ever came to him without getting his deserts.

Before his departure from this country, about 400 among his host of friends representing what is best in Chile's governmental, diplomatic, mining, banking, and industrial circles attended a farewell luncheon given in his honor at the Santiago Union Club. Public testimony was given to the high regard and esteem which Chile has for this mining engineer, especially for his services which led to the signing of the ore-buying contract between Metals Reserve Co., whose representative in Chile Mr. Graham was, and the local mining industry. The Chilean Secretary of State presented Mr. Graham with the order "Al Merito" in the grade of "Gran Oficial."

★Considerable apprehension has been felt in Chilean mining circles on account of the fact that the contract between the Chilean Government and the U. S. Commercial Co. has not yet been renewed for a further period of six months, as has been the case since the contract was signed on Feb. 1, 1942. As is well known, on the basis of this contract all Chilean production of copper and gold ores and concentrates was bought by the above-mentioned company under a schedule which most miners considered satisfactory. Since shipping has been very scarce, the same agency took over, on a cost-plus basis, the local smelters of Chagres and Naltagua, whose combined capacity of about 110,000 short tons of ore a year enabled U. S. Commercial Co. to smelt in Chile about half of the country's total production of ores and concentrates and export copper as 99.2 percent blister, with considerable saving in ship space. According to the latest figures, production for 1944 will be as follows:

	Metric Tons
Copper ores	80,000
Gold and copper ores	13,500
Copper concentrates	55,000
Copper and gold concentrates	13,000

★Though at first sight this production may seem small compared with the electrolytic and blister production of the Chile, Andes, and Braden companies, which has reached almost half a million metric tons of fine copper a year since Pearl Harbor, nevertheless it has a considerable economic importance in this country on account of the appreciable labor force it employs, which in round numbers has been placed by government bureaus at 175,000 men, including those that work at the mines, mills, smelters, and transportation.

This kind of mining, which is carried out in literally hundreds of small mines in the northern part of the country, has been hard hit by the war on account of inflation, which has rapidly increased the cost of mining. Manufacturers and farmers can defend themselves by increasing prices as costs rise, but as the miner is compelled to sell abroad, he is bound to absorb the rise and either go into the red or out of business.

Another unfortunate consequence of the war was the impossibility of building the Paipote smelter near Copiapo, which had been decided on and the contract placed with Allis-Chalmers when Pearl Harbor happened along. This smelter, whose site is strategic with respect to northern mining, would have permitted the reduction to bar copper of the other half of Chilean ore and concentrate production, and the whole of the country's output could have been shipped to the States as blister copper ready for refining.

★The Chanaral-Taltal company, which for many years has been the principal producer in the Altamira gold camp, has recently built a new cyanide mill. This is an all-sliming mill with a capacity of 60 metric tons a day. Until the company decided to build its own plant, the ores from the company's and neighboring mines were cyanided at the Caja de Credito Minero's Salado mill; but increased cost of freight made transportation of the lower-grade ores by truck and railroad an economic impossibility. This mill will permit treatment of appreciably lower tenors of ore which previously had to be left underground or laboriously handpicked at the surface. A noteworthy feature of this plant is that all of its machinery was either built in the country or is reconditioned machinery originally imported from the States. This mill will use the old system of precipitation by zinc shavings in boxes instead of the Merrill-Crowe, now generally used in this country.

★For a number of years Du M'Zaita has been developing the Cerrado mine, 22 miles from the town of Cabildo on the Longitudinal Railroad. This is a small copper property consisting of a well-defined, flat-dipping, 5-ft. vein with a long strike and well-defined and regular oreshoots. The chief minerals are chalcopyrite and pyrite, and grade is 3.4 percent copper, with some gold values. This company, which owns the nearby smelter of Chagres, would have run short of sulphur for its matte had it not been for purchased copper and gold-copper concentrates, but in order to make sure of its own supply of sulphur for the smelter, this property was developed.

The mill treats 120 tons of ore a day and the machinery is the same that for

over 23 years treated the ore from the Caracoles mine, near San Felipe, now worked out. That this machinery could be reconditioned and used again after 23 years of continuous operation is a credit both to American manufacturers of milling machinery for excellent design and workmanship, and to the Chilean engineers for their care in operating it.

★The General Council of Ipimegeo (Pan American Institute of Mining Engineering and Geology) held its first meeting in Lima, Peru, Dec. 4–8, 1944. The following engineers were elected to form the Executive Council for the period 1945–1947: M. Rodriguez, R. Müller, T. Leighton, O. Vergara, T. Vila, E. Vial, and M. Garces. All of these members are Chileans, as the seat of the Executive Council is in Santiago, Chile. Nine important resolutions were unanimously approved in the last session, pertaining to the completion of the geological maps of the Americas; the advancement of economic geology in all the American nations; to foster the establishment of scientific and technological institutes for research; the adoption of the same system of weights and measures and of the same geological and mining terms; the interchange of geological and mining professors, engineers, and students; the establishment of post-graduate advanced courses in the higher seats of learning; the creation of a central library at the seat of the Executive Committee and of libraries in each of the national sections; and the publication of a magazine for Ipimegeo.

PERU

Vanadium leaching plant completed at Jumasha—Mining congress convenes at Lima

★Completion of a crushing plant and drier at Minaragua and an ore-treatment plant at Jumasha, for the Vanadium Corp. of America, has been announced by the Rust Engineering Co., Pittsburgh, U.S.A. The mine plant is at an elevation of 15,600 ft., and the metallurgical plant at 14,200 ft. A 6-mile narrow-gage road connects the two. From Jumasha the vanadium concentrate is shipped to Pittsburgh via Lima. At the treatment plant the ore is subjected to leaching, filtration, and precipitation. The precipitate is dried and packed for shipment. Serving the mill is a diesel power plant, pump and boiler house, 150 dwelling units for native labor, and hotel accommodations. Work on these installations was begun two years ago, and almost all the plant and equipment were brought from the United States.

★The Second Peruvian Mining Congress opened officially in Lima on Jan. 5, and closed Jan. 12. It proved to be a highly important meeting in which Peruvian and foreign delegates discussed many problems of current interest, and presented papers dealing

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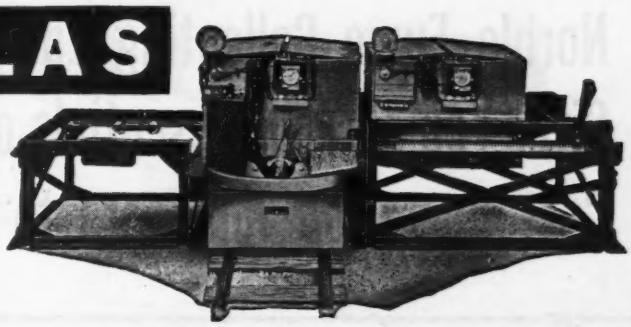

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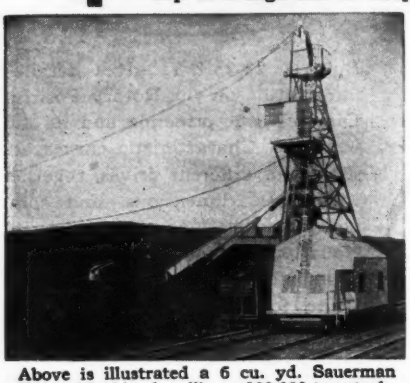

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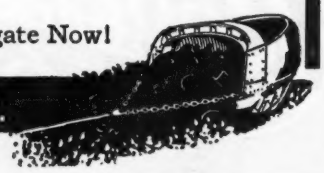

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Peru (*continued*)

with local and general scientific and economic factors. United States delegate Donald H. McLaughlin, now general manager of Cerro de Pasco Copper Corp., was chairman of the Commission on Mine Valuation and, on that subject, held a conference which was attended by a large number of engineers and other technical men. Highlight of the Congress was the banquet served at Hotel Bolivar, given by Mr. Eulogio Fernandini, President of the Sociedad Nacional de Mineria, in honor of the President of Peru, Dr. Manuel Prado. There were several excursions in honor of the foreign delegates, notably that offered by the Director of Mines and Petroleum, Dr. Artidoro Alvarado, at Huachoc, a gold mine only 1½ hours south of Lima.

★The Second Peruvian Mining Congress was complemented by an exposition of the mining industry on Jan. 31. Most of the mining and oil companies, and some of the firms that import mining machinery, made elaborate exhibits showing mine exploitation, milling machinery, oil derricks, and a small but complete oil refinery.

★The recent drop in the price paid to Peruvian producers of zinc concentrates and ores, of from $0.06 to $0.05 per pound of metal contained, is seriously affecting most of the zinc mines, whose profits have never been large.

★The local price of lead ores and concentrates has recently increased between 0.36c. and 0.59c. per pound of contained metal, the price varying according to the grade of the concentrate. This increase is mainly due to lower loading and shipping costs.

AUSTRALIA

Labor shortage, high wages, and other costs affect all mining operations adversely

WESTERN AUSTRALIA

★Edna May (W.A.) Amalgamated Gold Mines, N.L., is working a group of leases at Westonia, the district being situated toward the western margin of the State's auriferous areas. Some two years ago, following completion of a new main shaft to the 575 level, erection of a new crushing plant, and connections to the existing mill, the company came onto the dividend list; but war conditions, causing serious shortage of labor, combined with a considerable fall in grade, have since made operations difficult, and the financial year to June 30, 1944, showed a loss. Only 1,398 ft. of development could be completed. Ore mined and treated amounted to 10,976 tons, which was much below normal plant capacity. Gold recovery by amalgamation was 2,874 oz., or 5.24 dwt. per ton, and sands stacked for subsequent cyanide treatment assayed 1.75 dwt. per ton, making a total head value of 6.99

dwt. per ton. Sand treatment recovered 603 oz. of gold from 8,832 tons of sand treated, an average of 1.37 dwt. per ton, and final residues assayed 0.39 dwt. per ton. The ore contains small quantities of wolfram and scheelite, and a treatment plant has been in operation recovering these minerals from the accumulated tailings of the earlier operating companies. This section of the work treated 15,050 tons of material for the recovery of 23.95 tons of tungsten concentrates containing 1,555.74 units WO_3, which was a profitable result. The lodes are quartz carrying finely disseminated gold with pyrite, marcasite, and galena in small quantities, as well as wolfram, scheelite, molybdenite, and wulfenite.

★Considering the increasing difficulties of mine operation, South Kalgurli Consolidated, Ltd., Kalgoorlie, maintained a satisfactory position in the year ended March 31, 1944. With a deteriorating labor position, the company decided that it would be more satisfactory to close its own milling plant and have the ore treated at the mill of the Kalgurli Ore Treatment Co. The changeover proved satisfactory and the arrangement will continue until the end of the war. The average grade of ore mined was 5.19 dwt. gold per ton and the recovery from normal operations was 15,450 oz. of gold, supplemented by 1,770 oz. from the clean-up of the company's mill.

NEW SOUTH WALES

★Wartime regulations are responsible for deletion of the usual operating details from the annual reports of the Broken Hill mining companies. North Broken Hill, Ltd., had a reasonably successful year, which was marked by the usual shortage of skilled miners and other labor. A net profit of £A283,242 was made after providing £A134,000 for taxation and royalty and £A75,000 for depreciation. Development was restricted by circumstances, but two important items of work were carried out. These were the sinking of the No. 2 shaft below the 2,920-ft. level and the continuation of the exploratory drive northward on the 2,600-ft. level. This drive will be used for the exploration and exploitation of the orebody in the De Bavay fault area, and also of the northern leases. Since the latter were acquired by the North company, the policy has been to plan for their exploration from a deep level in the mine, and for this work the 2,600-ft. level will be used as a base. Recoveries for the past three years were:

Year Ended June 30	Lead, %	Silver, %	Zinc, %
1942	96.9	91.8	86.4
1943	96.5	90.9	86.3
1944	96.6	90.9	86.2

The percentages do not give much scope for betterment, but improvements in milling have reduced the quantity of lead contained in the zinc concentrates.

★The property of New Broken Hill Consolidated, Ltd., adjoining the Zinc Corporation mine on the south, is managed by that company. The agree-

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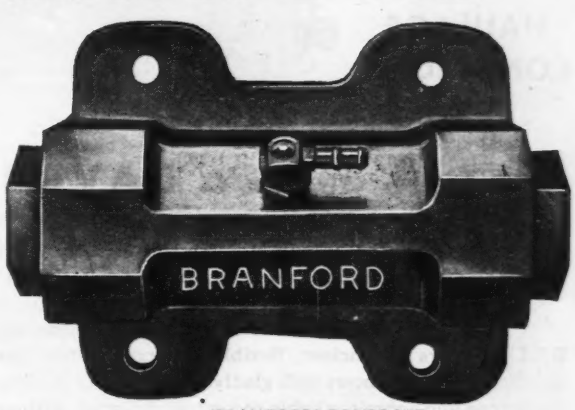

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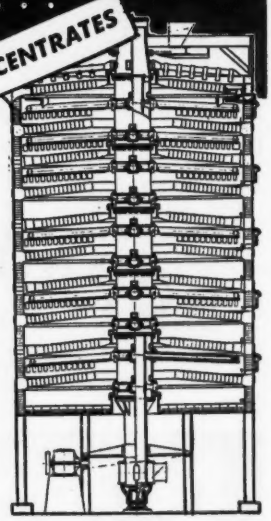

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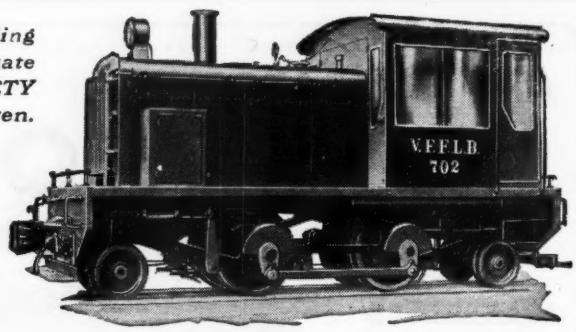

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Australia (*continued*)

ment between the two organizations provides for the treatment of New Broken Hill's ore at the Zinc Corporation mill, and all underground work is planned to coordinate with the layout of the latter mine, the main shaft of which is the main hauling shaft for the New Broken Hill mine. The ventilation scheme which is nearing completion is common to both mines. New Broken Hill mine is still largely in the development stage, and little actual production has yet been undertaken. The main locus of operations will be below 1,800 ft. from surface, little if any ore of economic importance occurring above that horizon.

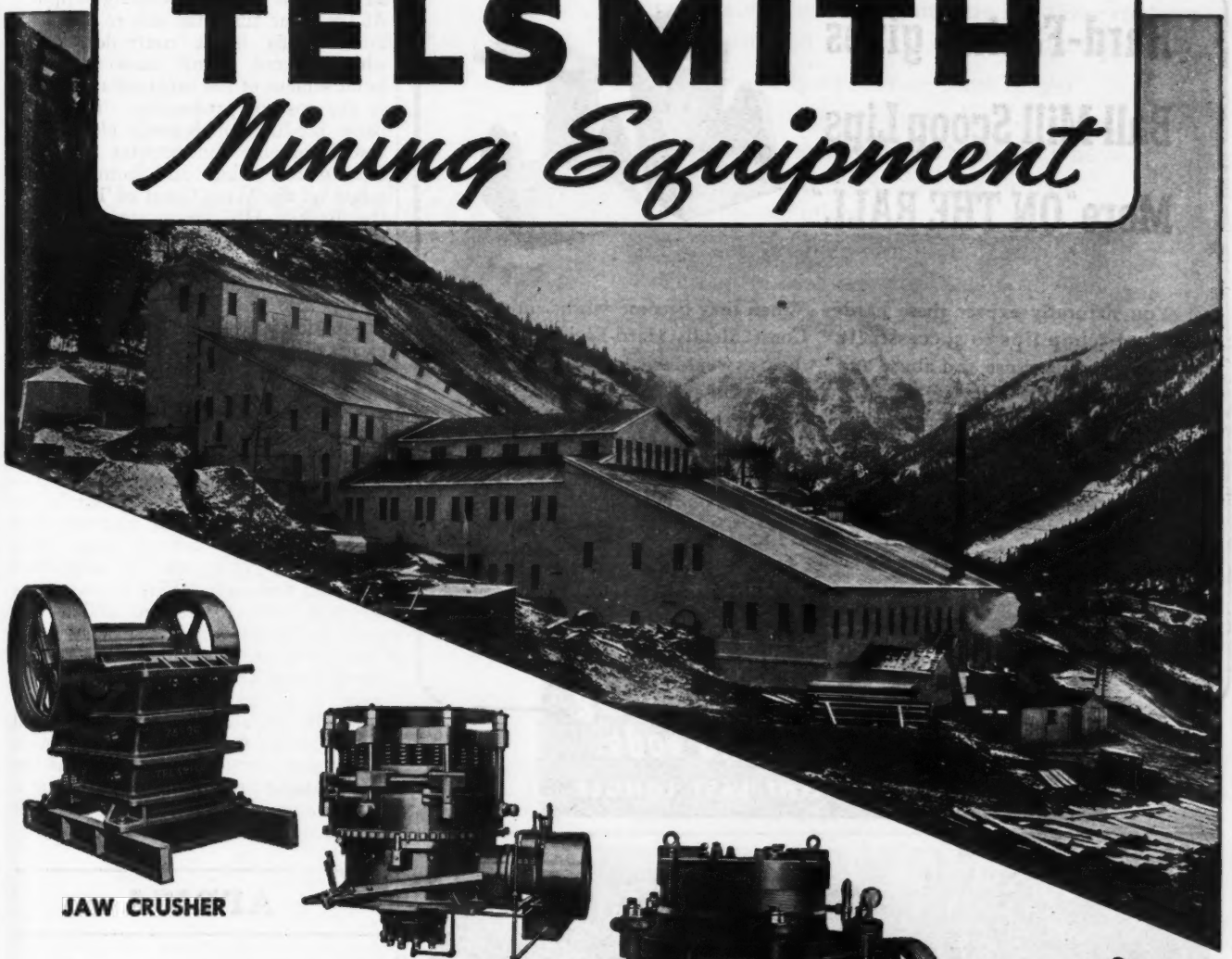
TASMANIA

★One of the most important tin and wolfram producing mines in the Commonwealth is that owned by Aberfoyle Tin, N.L., situated at Rossarden, 40 miles southeast of Launceston. The tin and wolfram deposits are chiefly quartz and greisen veins, occurring in both the granite and intruded slates. In the Aberfoyle mine, the veins attain lengths of several hundred feet, with widths of a few inches up to 3 or 4 ft. The ore consists of quartz with veinlets or scattered grains of cassiterite, wolfram, pyrite, and a little zinc blende and fluorite. In the year ended June 30, 1944, the company earned a net profit of £A35,501. Ore mined from four levels totaled 16,553 tons, from which was produced 328 tons of tin concentrates assaying 74.38 percent Sn, and 66 tons of wolfram concentrates containing 71.36 percent WO_3. Manpower has permitted a forward development policy and the main shaft was sunk from a depth of 405 ft. to 641 ft. and levels were opened out at 507 ft. and 627 ft. Other development work totaled 1,145 ft. Ore reserves were estimated at 58,500 tons of positive ore and 5,412 tons of probable ore.

★Mount Lyell Mining & Railway Co. Ltd. earned a net profit of £A109,209 in the year ended Sept. 30, 1944, compared with £A169,141 in the previous year. Shortage of labor of all classes was felt more severely than in any other war year and mining operations were adversely affected. Development of open-cut areas was retarded, and underground mines were worked on a reduced scale. It was finally necessary to close the Lyell Comstock mine to utilize labor to better advantage elsewhere. Ore production was therefore less, the grade was lower, and the output of copper decreased in comparison with the previous year.

★Electrolytic Zinc Company of Australasia, Ltd., reported a profit of £A292,574 for the year ended June 30, 1944, after provision of £A222,000 for taxation and £A101,733 for amortization and depreciation. Adverse factors affecting operations were the serious shortage of labor and high production costs due to increases in wages and introduction of "wartime allowances;" to lower operating efficiency, and to

TELSMITH
Mining Equipment



JAW CRUSHER

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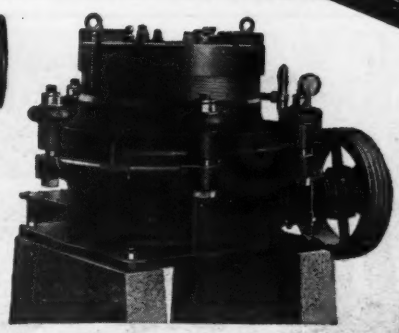

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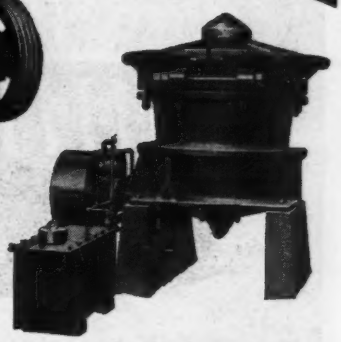

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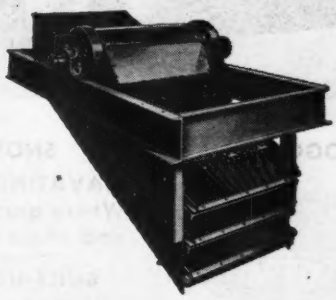
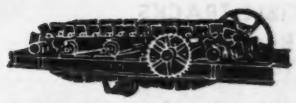


VIBRATING SCREEN

GRIZZLIES



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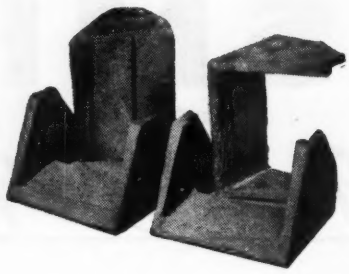

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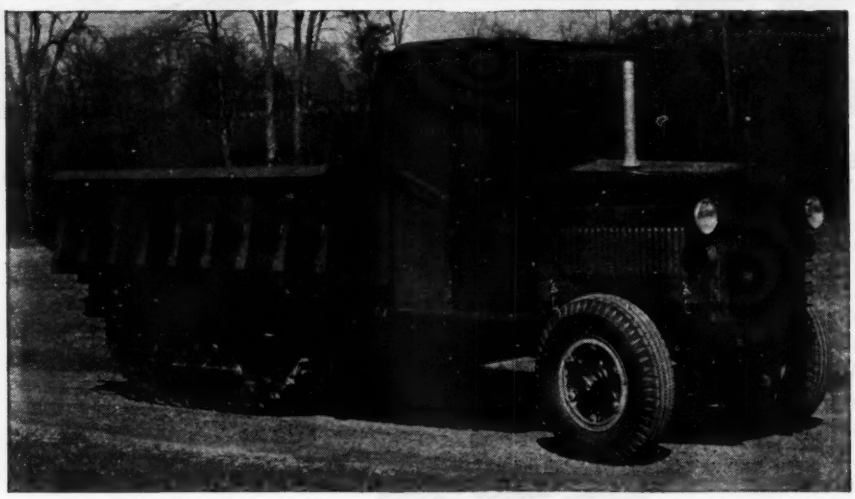

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Australia (*continued*)

advances in cost of operating supplies. At the same time, the sale of products in Australia is at controlled prices which do not permit recovery or reimbursement of the substantial increase in the cost of production. The company produces high-grade electrolytic zinc from zinc concentrates from the Broken Hill mines and from its own mines on the West Coast of Tasmania, the Broken Hill group supplying approximately two-thirds of the capacity of the Risdon works. Cadmium is an important byproduct, amounting to about 200 tons per annum. Zinc production for the year was somewhat in excess of the demand and unsold stocks increased by 3,200 tons.

NEW ZEALAND

★The Dominion's greatest gold mine, operated by Martha Gold Mining Co. (Waihi), Ltd., experienced great difficulty through shortage of labor in the last financial year, and matters have reached such a critical stage that continuance of work is imperilled although the undertaking is classed as essential work. Tonnage milled was good in the circumstances, being 6,420 tons less than in the previous year, and ore reserves were also reduced. Costs have increased. The mine is being gradually exhausted, and its life will not be long. Gold duties and taxation were nearly three times as much as the distributable profits for the year, and a continuance at the present level will hasten the end of the mine.

AFRICA

Mine development urged for postwar employment—New 7,000-ft. shaft for Van Dyck

★The probability that at least four separate gold-mining companies would be established south of Odendaalsrust was the keynote of a lucid review of Free State operations given by Sir Ernest Oppenheimer in his speech at the O.F.S. Trust meeting in December last. The Trust would have a substantial interest in these ventures. Drilling in the proved areas there had indicated the presence of gold in payable quantities. These results had been confirmed by further drilling and subsequent intersections. The discoveries in these areas justified an approach being made to the government, in the opinion of Sir Ernest, for the grant of mining leases in order to commence shaft sinking and development.

★G. Carleton Jones, chairman of West Witwatersrand Areas, stated at the annual meeting of that company, that it was urgent, in the national interest, that new mines should be opened up to take the place of dying mines. Industries engaged on war production had absorbed labor, but many such projects would not be able to turn to profitable peace-time produc-

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THIRTY YEARS SERVICE TO THE MINING INDUSTRY IN THE MARKETING OF ORES AND THE SUPPLY OF MINING EQUIPMENT AND SUNDRIES

Africa (*continued*)

tion, and were likely to release labor in the future. It was for that reason that Carleton Jones sounded a warning.

★The finding of the joint inquiry on the recent fire on No. 2 shaft, Van Dyk Gold Mine, and the deaths underground of three European officials and a native laborer, has been issued. Exhaustion followed by carbon monoxide poisoning was the cause of the deaths, states the finding, which adds: "It cannot be established who was responsible for starting the fire, which started near miners' tool and explosives boxes and which was reported to be extinguished on Friday, Nov. 10. The accident was not due to an act or omission of a criminal nature nor to the contravention of a statute or statutory regulation by any person."

The tragic deaths of three officials in the fire served to focus perhaps undue attention on the fire hazard in the gold-mining industry, with its potential danger to life and disruption of mining activities. The danger is always present, but much has been done in recent years to eliminate potential fire hazards and guard against outbreaks.

★Acting on the recommendations of the consulting engineers, the directors of Van Dyk Consolidated Mines (Union Corporation group) announce that, to safeguard the maintenance of future production, the sinking of a two-stage vertical shaft to a depth of about 7,000 ft. is to be undertaken immediately.

It has always been evident that at some future time a deep-level shaft would have to be sunk to explore the southern area and to provide ore for the reduction plant. It had not been anticipated that a decision on this matter would be required for some years, but development in depth in the northern section in recent years has disclosed a zone across the property containing a low proportion of payable ore. It is believed that this zone is of limited extent and that normal conditions will be found farther south.

It is estimated that the program now to be undertaken will involve an outlay of about £1,250,000 over six years, the bulk over the first three years. The expenditure will be financed out of profits, involving a curtailment of dividends for the second half of 1944 to 3d. per share.

★Possibly the most significant feature of the quarterly reports is the evidence they furnish of increasing development operations, which, as is generally known, had been greatly curtailed in the earlier years of the war to conserve materials, particularly steel, needed for more immediate war purposes. Shortage of native labor was also a factor. The marked improvement to be noted from the accompanying table shows how the gold-mining industry is preparing for future expansion in gold production, by building up once more ample ore reserves.

★The award of the arbitrators appointed to "settle a labor dispute between the Mine Workers' Union and the Daggafontein Mines, Ltd., arising out of the introduction by the company of a new system of stoping, coupled with a reduction in the price per fathom broken, and the refusal of the company to accede to the union's demand for payment under this system of the same price per fathom as under the previous system," was gazetted recently by the Wage Board, which acted as arbitrators. The award says that, "The demand of the Mine Workers' Union was not justified and is not acceded to." The award will be binding from Dec. 1, 1944, to Nov. 30, 1945.

★With a slightly shorter working period the group gold-mining returns for November show decreases in both milling and profits compared with the October figures. Milling in November totaled 4,728,800 tons, a decrease of 90,200 tons. Aggregate profits were £2,650,301, which was £85,330 less than the total for October.

The Van Dyk fire accounted for much of the decreases under both heads. Interfering as it did with operations for a third of the month, it had the effect of reducing milling at the mine from the October figure of 100,000 tons to 72,000 tons for November, raised working costs from 28s. 1d. to 37s. per ton milled, and reduced the profit from £46,431 to £566.

Details of November gold production in comparison with October are as follows:—

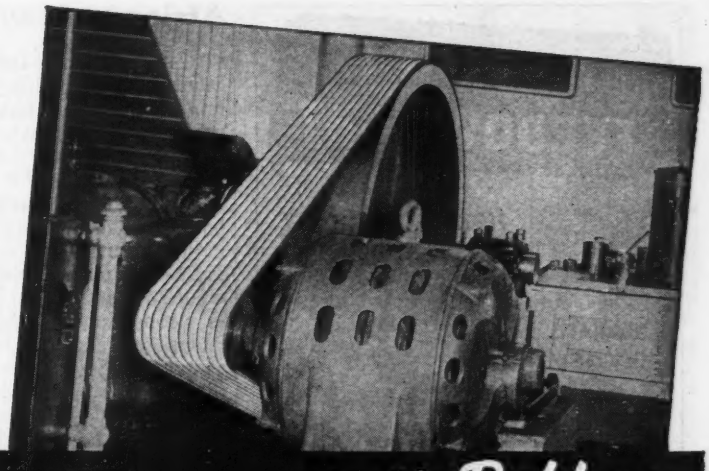
	October, Fine Oz. Gold	November, Fine Oz. Gold
Witwatersrand	1,001,477	983,909
Other districts	23,097	23,077
Totals	1,024,574	1,006,986
	October £	November £
Witwatersrand	8,412,407	8,264,836
Other districts	194,015	193,847
Totals	8,606,422	8,458,683

(Value at 168 s. an ounce fine.)

★The government did not accept in full the recommendations made by the Witwatersrand Mine Natives Wages Commission, but nevertheless decided that as from April, 1, 1944, certain increases should be made in the wages paid to Witwatersrand mine native laborers. Briefly, these amount to 5d. a shift for natives employed underground and 4d. a shift for natives employed on the surface, with payment

South African Mine Development in 1944

	Development Footage March 31 '44	June 30 '44	Quarter Ended Sept. 30 '44
Rand Mines Group (13 producers)	75,056	90,832	106,016
Barnato Group (7 producers)	29,007	28,456	27,494
Anglo Amer. Corp. (7 producers)	46,580	48,706	51,953
New Cons. Goldfields (8 producers)	71,980	84,686	94,143
Union Corporation (6 producers)	37,803	38,004	41,029
Gen. Mining Group (2 producers)	22,896	22,657	24,343
Individual and miscellaneous (approx.)	35,873	36,443	32,318
Total footage	319,204	349,784	377,296



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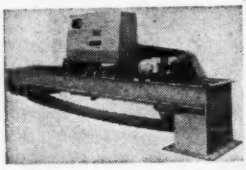

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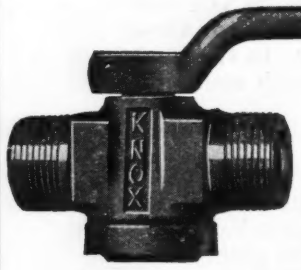
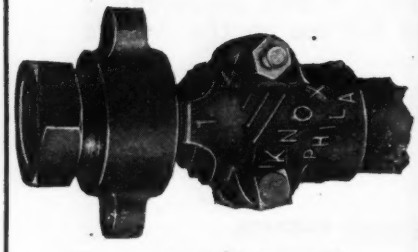


Male or Female Threads



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Africa (*continued*)

of time and a half for all overtime and Sunday work. Since Jan. 1, 1940, gold mining companies have been obliged to pay to the government a gold realization charge, and since Sept. 1, 1940, this has remained fixed at 38s. 3d percent. The government decided to place in a pool the sums thus collected from the industry during the year ending March 31, 1945, and to distribute these funds among the individual mining companies in proportion to their share of the increased costs of the industry in respect of native wages. On present estimates the amount thus made available will only be sufficient to meet about 90 percent of the additional direct burden placed on the different mining companies.

★Southern Rhodesia gold production in October 1944 amounted to 48,973.47 oz., valued at £411,377, which is a drop in value of £2,497 from the September figure. The total mineral production, including silver valued at £828, thus amounts to £712,060, or an increase of £27,743 on the September figure. The grand total production of minerals in the Colony is now estimated to be up to the end of September 1944, about 27½ million ounces of gold, 6¼ million ounces of silver, precious stones valued at £83,438 and base minerals at £49½ million, with a total value of almost £198 million.

On the Witwatersrand and extensions, which include all members of the Transvaal Chamber of Mines, the fatal accident rate for the first ten months of 1944 was 1.39 per 1,000 persons employed, which is a new low record.

Reflections (*Cont. from p. 107*)

are more or less important to national security than materials in any other group."

The quantities are contained in two unpublished tables, one of which gives the recommended amounts of group A materials to be stockpiled and the other giving the same for group B.

To quote the report, "The quantities have been computed on the basis of certain strategic assumptions furnished to the Board by the Joint Chiefs of Staff, and United States consumption (including military, lend-lease, and essential civilian requirements) during the peak year of the present war to date. In addition, the figures reflect the following considerations:

"(a) Compensation for any known depletion of, or reasonably certain increases in, available resources in the United States;

"(b) A similar compensation for known anticipated changes in resources of material outside the United States (as to which we have comparatively meager information at the present time);

"(c) Adjustment for anticipated increases or decreases in future military requirements as the result of technological changes already evident;

"(d) Adjustments wherever consumption data indicate that it has been necessary to use inferior grades of material in the present war; and

"(e) Limitations imposed upon the stockpiles of perishable materials by reason of the necessity of rotating the quantities involved.

"For group B materials the minimum quantities recommended in Table IV are in each case zero, as the supply of these materials can be assured by means other than stockpiling.

"The maximum quantities for group A materials represent those quantities necessary, in the Board's opinion, to provide additional security, based on current evaluation of certain considerations other than those above. Included among such considerations are:

"(a) Supply from foreign sources as it may be affected in a future emergency by international political and economic conditions;

"(b) The inordinate expenditures of manpower, equipment, and money which may be required to build up supplies of certain materials;

"(c) Maintenance of an industrial economy at a higher level of efficiency than that prevailing during the present emergency by minimizing drastic dislocations resulting from critical shortages; and

"(d) Requirements as they may be effected by the civilian needs of a population of the United States larger than the present population.

"The maximum quantities for group B materials have been established on the basis of considerations similar to but not identical with those used in determining group A maxima.

"These considerations will require continuous review and analysis, by all government agencies concerned, of both the minimum and maximum quantities established."

Referring to the quality of material to be stockpiled, the report stated that suitable specifications had been prepared and were on file in the Board's office. These specifications in general called for high-grade materials, and the Board urged that any low-grade material automatically frozen in the stockpile in pursuance of Sec. 22 of the Surplus Property Act should either be converted to fit specifications or should be excluded from the minimum quantities.

The Board also urged relaxation of the Buy American Act, giving a 25 percent preference to domestic production purchased by government, and provisions of the 1939 stockpile act giving domestic producers a year in which to make deliveries. It recommended legislation to provide for disposal of materials becoming technologically obsolete and that an early start should be made in acquiring stockpiles. Also, it called attention to the requirement that a logical security program should include standby facilities, pilot-plant operation, and continued technical research.

Immediately after the report was made public, Senator Scrugham issued a statement attacking the Board's attitude toward preferences for domestic producers and disposal of any stockpiled material except through Congress.

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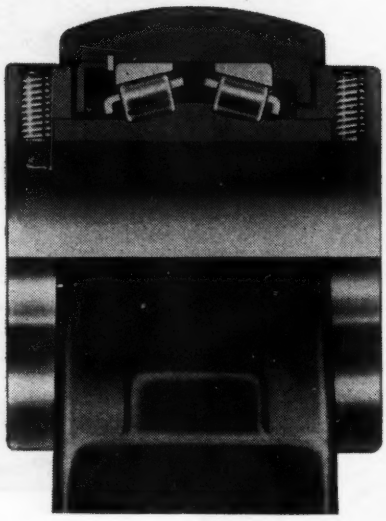
EQUIPMENT NEWS

Pillow Block Bearing



A new Dodge-Timken bearing is announced by Dodge Mfg. Corp., Mishawaka, Ind. As illustrated, it is designed to give 30,000 hours or more of service under conditions for which it is adapted. The method of fastening to shaft is simple and effective. On each end of the extended inner race is a steel collar having two headless setscrews spaced 120 deg. apart and extending through clearance holes in the inner race to the shaft. These four setscrews provide a positive lock to prevent rotation of the inner race on the shaft. Simple, effective labyrinth seals prevent loss of lubricant and protect bearings against damage from dust, dirt, or moisture. These seals are equally effective whether the bearing is on or off the shaft. The bearings are completely assembled, lubricated, and adjusted at the factory.

Additional Braking Aid For Trucks

The use on trucks of a braking device that operates on water supplied from the radiator through the cooling system and is independent of the mechanical brakes is said to lower brake maintenance costs and to save gas and oil as well as wear on the motor. This device, known as the "Hydrotarder," made by Parkersburg Rig & Reel Co., Parkersburg, W.Va., is controlled by a "choke-type" rod on the dash, which is pulled out or pushed in as necessary. The device has four principal parts—a right- and a left-hand stator, which are journaled on the shaft and serve as a housing, and a rotor keyed to the main drive shaft. Triangular pockets in the rotor and the two stators receive the water from the jackets. When the rotor turns, this water circulates between it and the stators at high velocity. The flow is interrupted every time two pocket walls pass each other, causing a turbulence, generating heat, and thus absorbing energy.

Specifically it is claimed that this device applied to a truck in the Iron Country controls descent in overdrive or direct gear, and eliminates gearing-down. It is said to minimize engine repairs and overhaul by eliminating the tendency of the driver to brake with the engine. By removing the necessity for "snubbing" with air brakes to decrease travel speed, it reduces wear on linings. It permits prompt, dependable braking with the air brakes in emergencies and at destination because they remain cool. It also saves tires by preventing heating and friction due to application of air brakes. It does not, however, eliminate the necessity for mechanical brakes. It does not actually stop the truck, but prevents it, at the choice of the driver, from traveling at speeds which otherwise would require "snubbing" by mechanical brakes.

Fastener for V-Belts

A new fastener for A and B section V-belts, known as Flex V, has been developed by the Flexible Steel Lacing

Co., Chicago 44, Ill. As shown in the accompanying illustration, the fastener consists of two V-shaped plates, an alloy metal hinge pin, and self-tapping screws for securely fastening the end plates to the belt ends. A simple applicator is used to prepare the belt ends, place and align the end plates, and hold the screws upright during the actual fastening process. The separable hinge joint permits quick, easy replacement of V-belts without dismantling line shafting or machinery.

INDUSTRIAL NOTES

F. T. D. Meares, manager of the mechanical plant department of **Noyes Bros.,** engineers, Sydney, Australia, arrived in the United States about mid-February for a two-months visit. American firms interested in the Australian market for electrical and mechanical equipment can get in touch with Mr. Meares through American Express Co., Inc., 65 Broadway, New York City.

Rockford Drilling Machine Co., a division of Borg-Warner Corp., Rockford, Ill., has changed its name to **Rockford Cluth Division** and will operate the research laboratory at Rockford.

Northwest Tube & Metal Fabricators have announced plans for establishment in Portland, Ore., of a factory for manufacture of steel tubing for hydraulic mining and other purposes. Sales on the Pacific Coast will be handled through regular jobbing channels.

Hercules Motors Corp., Canton, Ohio, has published a booklet by Lowell Thomas, illustrating and describing its variety of gasoline and diesel engines.

Cleveland Pneumatic Tool Co., Cleveland 5, Ohio, has marked the 50th anniversary of the organization of the company and its subsidiaries by the publication of a brochure entitled "Pioneers for 50 Years."

Eimco Corp., Salt Lake City 8, Utah, announces the establishment of a new branch office in the Paul Brown Bldg., St. Louis, Mo., under the management of **James K. Russell.**

Allis-Chalmers Mfg. Co., Milwaukee, Wis., announces the appointment of **U. E. Sandelin** as manager of the company's district office in Seattle, Wash. He succeeds **A. J. Schmitz,** who has been named Pacific regional manager, with headquarters in San Francisco.

Eshelby F. Lunken, president of the **Lunkenheimer Company,** Cincinnati, Ohio, valve manufacturers, died suddenly Jan. 25, 1945, at the age of 54.

BULLETINS

Electric Drills. Bulletin No. E-806, Pneumatic Tool Co., Chicago 6, Ill., on a new development of Thor "armored-in-plastic" portable electric drills.

Wet Flashlight Batteries. B. F. Goodrich Co., Akron, Ohio, has issued a catalog section on recharging equipment for wet flashlight batteries, operated from the ignition system of automotive vehicles.

Hose Couplings. Handbook on selection of couplings and method of attaching to hose. Hose Accessories Co., Philadelphia 32, Pa.

Conveyors. Bull. No. 462 of Chain Belt Co., Milwaukee 4, Wis. Deals with Rex apron and pan conveyors for ore and rock.

Pumps. Byron Jackson Co., Los Angeles 54, Calif., has published Bull. No. 44-5000 on "deep-well" pumps.

Tractor Vehicles. Illustrated folder on "Haftrak" vehicles, capacity 5 to 50 tons. Linn Manufacturing Corp., Morris, N.Y. Available in English, Spanish, and Portugese.

Motors. Crocker-Wheeler division of Joshua Hendy Iron Works, Ampere, N.J., has issued an illustrated bulletin on a new protected-type motor.

Flotation Reagents. Data on types and use of flotation chemicals are the subject of Bull. No. RI-B of Denver Equipment Co., Denver 17, Colo.